SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

SPECIAL BULLETIN.

AMERICAN HYDROIDS.

PART II.

THE SERTULARIDÆ,

WITH FORTY-ONE PLATES.

BY

CHARLES CLEVELAND NUTTING,
PROFESSOR OF ZOOLOGY, UNIVERSITY OF IOWA.

WASHINGTON:
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Papers intended for publication in the Proceedings and Bulletin are referred to an advisory committee composed as follows: Frederick W. True (chairman), William H. Holmes, George P. Merrill, James E. Benedict, Otis T. Mason, Leonhard Stejneger, Lester F. Ward, and Marcus Benjamin (editor).

S. P. Langley,
Secretary of the Smithsonian Institution.

Washington, D. C., *April 15, 1904.*

INTRODUCTORY NOTE.

Almost all that was said in the introductory note to the first part of this work could truthfully be said here. At that time it was thought that the Plumularidæ was a much larger family than the Sertularidæ, and the author has been greatly surprised at the large number of species of the latter family that he has been called upon to discuss in the following pages, and the extent to which the literature on the subject is fragmentary and scattered will be apparent when it is said that not more than 20 species of Sertularidæ from American waters have been mentioned in any one publication up to the present time, while the present writer has found no less than 130 species that should be included in the American fauna.

This large number of species has been brought to light more through a careful scrutiny of foreign publications than through the discovery of new species in the large collections that have passed through the author's hands, although the number of the latter is by no means small, amounting to more than 30 new forms. The writer has thus been much impressed with the necessity of bibliographic work, and, as a result, has presented as full a bibliography and as complete synonymies of species as he has been able to secure. While this is true, it must be confessed that there is much still to be desired in this direction, and that there are many papers that have not been available for reference, as will be seen by consulting the list on page 143 of this work.

This bibliographic work has been greatly facilitated by courtesies from the authorities in charge of the Library of Congress in Washington, and by the courtesy of my colleagues at home and abroad, who have been generous in sending me their publications.

Almost all of the friends mentioned on page 2 of the first part of this work have continued to render aid in the preparation of the second part, and in addition I take pleasure in expressing my gratitude to the following:

To the Directors of the British Museum (Natural History) for portions of a number of Allman's types of the *Challenger* Sertularidæ; to Prof. G. M. R. Levinsen, of Copenhagen, for specimens, literature, and advice; to Prof. D'Arcy W. Thompson, of Dundee, for specimens and correspondence; to Dr. Clemens Hartlaub for his valuable publications; to Prof. Maurice Bedot, of Geneva; Dr. Kristine Bonnevie, of Christiania; Dr. Edward T. Browne, London, for literature; and Sir William Dawson and Prof. J. F. Whiteaves, of the Canadian Geological Survey, for specimens.

Among my own countrymen I have the pleasure to acknowledge aid from the following, in addition to those mentioned in the acknowledgments on page 2 of the first part of this work: Hon. George M. Bowers, for facilities granted for investigation at the laboratory of the U. S. Bureau of Fisheries, in Woods Hole, Massachusetts; to Prof. H. C. Bumpus for special favors at the same place; to Prof. William E. Ritter, of the University of California, for specimens; to Prof. Trevor Kincaid, of the University of Washington, for specimens; to Mrs. G. Gibbs for specimens, and to Dr. Harry Beal Torrey, of the University of California, for literature.

The author also desires to acknowledge with gratitude the great service rendered by his wife, and Prof. H. F. Wickham of the State University of Iowa, in verifying references and other bibliographic work connected with the preparation of this section of the monograph.

AMERICAN HYDROIDS.

SECTION 2.—THE SERTULARIDÆ.

ERRATA.

Page 46, 7th line from top, *cylindritheca* should be *cylindrica*.
Page 46, 2d line from bottom, *tamariska* should be *tamarisca*.
Page 46, 39th line from bottom, 77° should be 770.
Page 50, 7th line from bottom, *sertularioides* should be *rathbuni*.
Page 77, 30th line from top, *alba* should be *albida*.
Page 77, 4th line from bottom, *quadridens* should be *quadrifida*.
Page 102, last footnote, p. 1876 should be p. 221.

Third. Such investigations as have just been referred to led to a general understanding of the morphology of the Hydroida as a whole, and, as the Sertularidæ offered little that appeared to be novel, that family was naturally passed by in favor of groups offering more interesting, because more novel, structures for investigation.

The writers who have contributed most to our knowledge of the morphology of this family, purely systematic work being excluded, are the following: Louis Agassiz, who gives an excellent and superbly illustrated account of *Sertularia pumila*;[3] Allman,[4] who discusses the gonosome of

[1] American Hydroids. Part I, The Plumularidæ, 1900, p. 3.

[2] While this is true when the Sertularidæ and Plumularidæ are compared, it by no means follows that the Sertularidæ are of low rank when compared with the hydroids in general. Indeed, quite the opposite is true if we admit the view now very generally adopted that the sessile gonophores represent degraded medusæ. This matter, however, will be discussed later.

[3] Contributions to the Natural History of the United States, IV, 1862, p. 326.

[4] Monograph of the Gymnoblastic Hydroids, 1871, p. 50.

AMERICAN HYDROIDS.

SECTION 2.—THE SERTULARIDÆ.

MORPHOLOGY OF THE SERTULARIDÆ.

As indicated in the first part of this work[1] it is the intention to defer the general discussion of the morphology of the order to the last part. In accordance with this plan nothing will be discussed here except those structures which are peculiar to the Sertularidæ, or those which, while shared by other forms, still furnish peculiarities upon which diagnostic features can be based. In the former category will be included the operculum, although this structure is found in the Campanulinidæ, and under the latter head will be discussed other features, particularly the stem, the hydranths, the hydrothecæ, and the gonangia.

A little study will make it evident that the Sertularidæ contain few characteristic structures, at least as compared with the Plumularidæ, and that the family is therefore lower in the zoological scale.[2] It has therefore not received the attention from the morphologists that has been paid other groups. Indeed, it appears to have received less careful study than any of the other large groups of the Hydroida, and there are surprisingly few papers that more than touch on the morphology of this family. At first sight this seems rather strange, especially when we remember that this is the longest known and most familiar family of the order. This lack of interest is probably due mainly to the following reasons:

First. The earlier naturalists were nearly all of them systematists rather than morphologists, and studied the more superficial characters.

Second. When effective morphological investigation became practicable by the introduction of microscopical and histological technic, investigators became interested in the larger forms with larger and more conspicuous hydranths, as in the gymnoblastic forms, or the beautiful and wonderful medusæ attracted their attention, and their investigations were thus led to the colonies which produced the free medusæ; or the nematophores and conspicuous features of the gonosome of the Plumularidæ lured the student to the scrutiny of these intensely interesting structures.

Third. Such investigations as have just been referred to led to a general understanding of the morphology of the Hydroida as a whole, and, as the Sertularidæ offered little that appeared to be novel, that family was naturally passed by in favor of groups offering more interesting, because more novel, structures for investigation.

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[3] Contributions to the Natural History of the United States, IV, 1862, p. 326.

[4] Monograph of the Gymnoblastic Hydroids, 1871, p. 50.

Sertularia pumila and of *Diphasia rosacea;* Thallwitz[1] describes the origin of the sex cells in *Sertularella polyzonias;* de Varenne[2] published a careful account of the reproduction of *Sertularia pumila;* Allman, in the introduction to his Report on the *Challenger* Hydroids, discussed the gonosome of *Synthecium* (p. xxv), and the origin of the sex cells in *Sertularia pumila* (p. xxxiii); Levinsen carried on important investigations regarding the operculum, and published the results in 1892 and 1893;[3] Hartlaub, in his masterly work,[4] discusses some morphological problems, such as the operculum, hydrothecal teeth, and gonosome of *Sertularella*, although these discussions are merely incidental to the main purpose of the work, which is almost purely systematic.

One of my students, Mr. J. H. Paarmann, has done some excellent work, which has not been published, on the operculum. To these works I shall have frequent occasion to refer.

TROPHOSOME.

The general form of the colony in Sertularidæ is pinnate, the branches usually being on opposite sides of the main stem, the branches themselves being opposite or alternate. Simple, noncolonial forms are entirely lacking in this group, there being no such a thing as a mature hydranth with its hydrotheca entirely independent of others,[5] as is found frequently in the campanularians among the Calypteroblastea, and a number of tubularians among the Gymnoblastea. As a result we find the usual outcome of the communistic idea, the subserviency of the individual to the colony as a whole, and a tendency toward a bilateral rather than a radial arrangement of branches. This may account for the fact that nowhere among the Sertularidæ do we find a true verticillate arrangement of the branches, such as is found among the Campanularidæ in *Campanularia verticillata*, and among the Plumularidæ in *Antennularia antennina.* There are, however, a number of cases where the branches spring from all sides of the stem, as in several species of *Thuiaria.* In these cases we have the pinnate arrangement of branches modified by torsion into a spiral which may be rendered more or less obscure by the irregularity of the branching, but which is quite evident in *Thuiaria thuja*, for instance. A more open spiral is found in a number of species, illustrated by the very graceful colony of *Sertularia argentea* and *Hydrallmania falcata.* Unbranched colonies are uncommon in this family, although several are found in *Sertularia*, especially in the *Desmoscyphus* group, as, for instance, *S. stookeyi* (Plate V, fig. 6), and in the genus *Sertularella* several of the *rugosa* group, as, for instance, *S. rugosa*, are often unbranched.

Among the Sertularidæ are found the only species of hydroids that have regularly anastomosing branches, which sometimes form a rude mesh or network, as in *Dictyocladium flabellum;* and here also occur the only examples of hydrothecal branch origins that I have seen in the order. This is illustrated in the genus *Thecocladium*, not represented in American waters, and also by sporadic cases which are not infrequent in the genus *Sertularella*, as, for example, *S. dentifera* Torrey (Plate XXV, fig. 1) and *Abietinaria gracilis* Nutting (Plate XXXV, fig. 1). In all probability, however, this occurs occasionally in other groups, such as the Campanularidæ, although the present writer has not seen it there.

In size no sertularian yet reported reaches the maximum found among the Plumularidæ. (See Part I, p. 4.) The largest colonies that I have seen were those of *Thuiaria cupressina*, that attain a height of about 18 inches under favorable conditions. Kirchenpauer, however, reports specimens from the mouth of the Elbe that are 2 feet in height.[6] This is perhaps the maximum size reported for any sertularian. As a rule they are very much smaller, from 1 to 4 inches being the ordinary proportions. Many, of course, are much smaller than the

[1] Jenaische Zeitschrift, XVIII, 1885, p. 426.

[2] Recherches sur la reproduction des Polypes Hydraires, 1882, p. 27.

[3] Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjobenhavn, 1892, p. 22, and 1893, p. 41 et seq.

[4] Revision der Sertularella-Arten, 1900, pp. 10–12.

[5] An apparent exception to this statement is found in the case of *Sertularella solitaria*, a new species described beyond, which bears single hydranths on pedicels. It is possible, however, that the single known specimen may be immature and that the adult colony may resemble that of *S. fusiformis*.

[6] See Hincks, British Hydroid Zoophytes, 1868, p. 272.

minimum just given. Mature specimens of *Pasythea quadridentata*, for instance, are sometimes less than one-fourth of an inch in height. It must be remembered, however, that height is not necessarily a true criterion of the actual size of the colonies. Dr. Dall found a specimen of *Abietinaria gigantea* which consisted of 350 shoots, averaging 6 inches in length, estimated to contain 1,000,000 individual hydranths.[1]

The Stem.—In by far the greater number of Sertularidæ the stem is a perfectly simple structure, being monosiphonic (consisting of a single tube), composed of the normal histological layers as found in the hydroids, divided into more or less regular internodes. The regularity of the latter, however, is greater among the Plumularidæ than in the family under discussion. There are but two departures from this simple type of stem that are of sufficient importance to demand attention here. These are—

(*a*) The fascicled stem, as illustrated in *Sertularella gayi*. (Fig. 1). This consists of an aggregation of tubes that are closely adherent so as to form a compound stem made up of numerous tubes. There is a difference, which we will find to be more apparent than real, between the fascicled stem as found in the Sertularidæ and that found in many Plumularidæ and discussed in the first part of this work (pp. 4–8), where there is a central or axial tube from which arise all of the branches and a number of peripheral tubes that do not give origin to branches or hydrocladia,[2] and therefore it (the axial tube) has received the name "hydrocladiate tube." In *Sertularella gayi* this state of affairs does not *appear* to exist. On the contrary, the branches seem to arise from almost any of these tubes which compose the fascicled stem. In fig. 1 we have a portion of the stem which has been boiled in potash to loosen the connection between the tubes *in situ*. The upper part has been dissected with needles, so that the component tubes are separated. It is readily seen that the branches bearing hydrothecæ arise from several of the tubes instead of one. Sometimes these tubes seem to originate from one of the branches, as at *a* in the figure, and pass downward, giving off another branch, as at *b*. Again, one of the tubes can be traced for a long distance without giving any indication of branches. An examination of the point of attachment of this same specimen shows that the hydrorhiza appears to be made up of a continuation of these same tubes, which simply separate to form individual rootlets. I have elsewhere[3] shown that these hydrocladia and hydrorhizal elements are homologous in the Plumularidæ, and the same thing appears to be true here, and in some instances it is perfectly clear that the hydrorhizal elements are modified hydrocladia.

A further dissection of this specimen, represented in fig. 2, clearly reveals that this is constantly true in *S. gayi*. By carefully dissecting out the tube *a t* we find that it continues downward through the stem and is hydrothecate throughout, although the hydrothecæ are completely covered by the other tubes when in normal relation, being axial in the polysiphonic stem. We will therefore call it the axial tube. From the bases of the hydrothecæ on this axial tube are given off branches which pass downward in the form of tubes and in their normal relations form the accessory or peripheral tubes of the fascicled stem. (Fig. 2, *a*, *a*). We thus find that the accessory tubes are merely modified hydrocladia arising, as do the normal hydrocladia, from the bases of the hydrothecæ. Some of these accessory tubes thus formed give origin to other branches bearing hydrothecæ a long distance below the actual origin of the tube. (Fig. 2, *c*.) It thus appears that all of the branches arise either directly (fig. 2, *b*) or indirectly from the axial tube, the difference being that in the latter case they arise from accessory tubes that are themselves really modified hydrocladia.

This discovery is of great morphological and systematic importance, because it gives us a clue to the real origin of the accessory or peripheral tubes, a matter not hitherto explained in a satisfactory manner, so far as I know, although I have found the same condition of affairs in the plumularian *Cladocarpus paradisea*[4] and in a species of *Thecocarpus*, but did not at that time see the full significance of the fact.

[1] Clark, Alaskan Hydroids, 1876, p. 230.

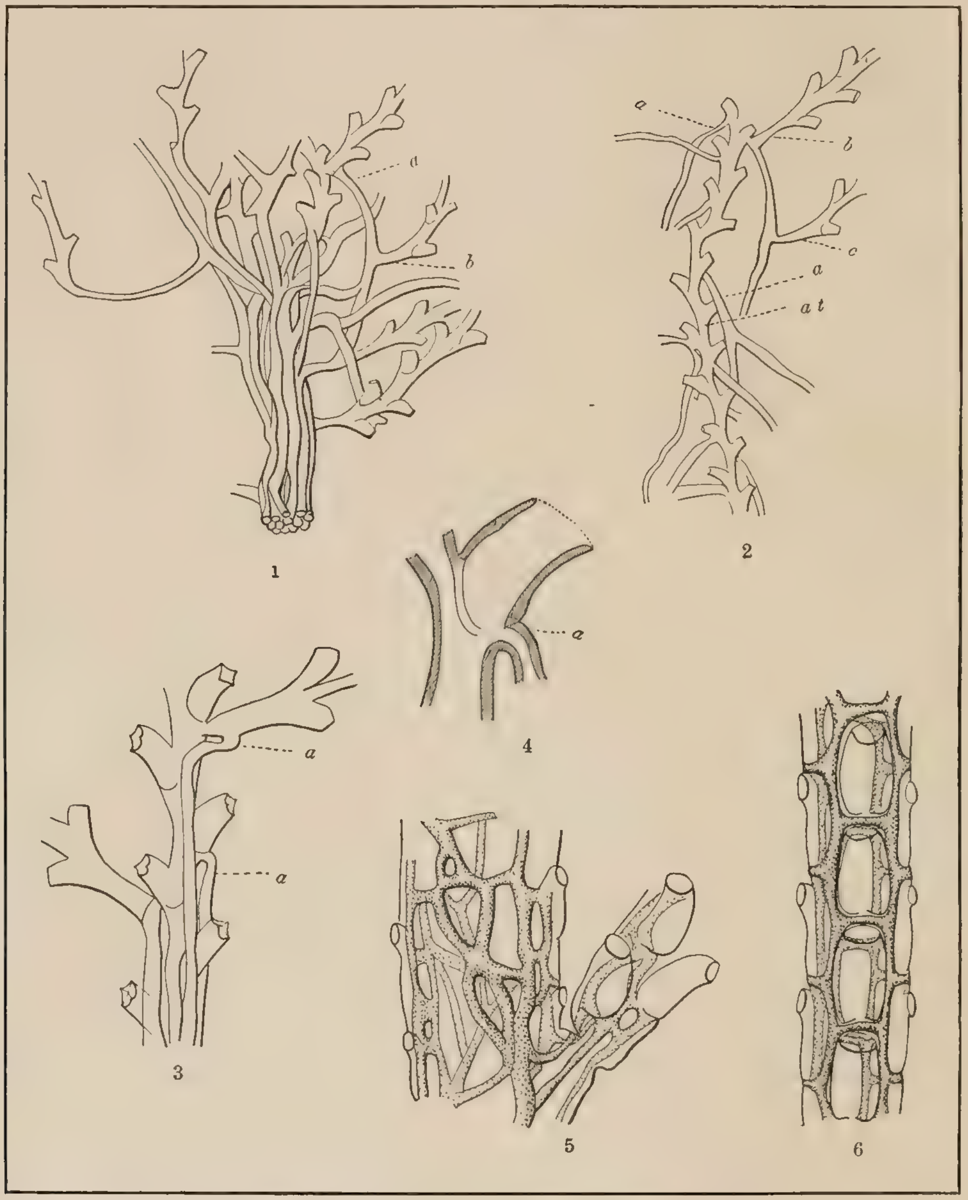
[2] The term "hydrocladia" as applied to the Plumularidæ signifies the ultimate branches which bear the hydrothecæ. It is not ordinarily used in connection with other groups.

[3] See Part I, p. 7.

[4] See Part I, p. 6.

By tracing downward some of these accessory tubes it is found that they end in hydrorhizal elements.

With these facts before us the entire manner of growth of such a fascicled stem becomes clear. The planula attaches itself, forms the primary hydranth, and grows upward in the form



THE FASCICLED AND CANALICULATED STEM OF THE SERTULARIDÆ.

Fig. 1.—Fascicled stem of *Sertularella gayi*, partly dissected to show the origin of the peripheral tube (*a*), and the origin of a branch from the peripheral tube (*b*).

Fig. 2.—The same specimen with the axial tube (*a t*) dissected out. *a*, *a*, peripheral tubes dissected out springing from the bases of hydrothecæ; *a t*, the axial tube; *b*, origin of branch; *c*, origin of branch from peripheral tube.

Fig. 3.—Part of distal portion of colony, more highly magnified, showing origins of peripheral tubes at *a*, *a*.

Fig. 4.—A single hydrotheca, greatly magnified, showing origin of peripheral tube at *a*.

Fig. 5.—Part of stem of *Selaginopsis ornata*, showing the extensive canaliculation of the cœnosarc; the dotted portions represent the cœnosarcal canals.

Fig. 6.—A branch of the same specimen, showing regular arrangement of the cœnosarcal canals.

of an ordinary monosiphonic stem. It gives forth branches from the bases of the hydrothecæ which at first form ordinary branches. As the colony becomes larger some of the branches turn immediately downward, become agglutinated to the original monosiphonic stem (now becoming the axial tube), and finally form a bundle of tubes which entirely conceals the axial tube and its

hydrothecæ, so that the presence of the latter would not be suspected without dissection. These branches (now become accessory tubes) themselves give off branches and pass on downward to the base of the stem, where they spread for a short distance over the base of attachment and function as hydrorhizal elements. We are thus able to homologize the ordinary stem of a fascicled sertularian with the apparently very different stem of some of the Plumularidæ. The axial tube of the sertularian is thus strictly homologous with the "hydrocladiate tube" of the plumularian.

But we can extend this homology much further, and find that it will apply to the perisiphonic stem upon which Allman bases his family Perisiphonidæ. That writer says:[1]

> There is among the Calyptoblastic Hydroids no more natural and distinctly defined family than that of the Perisiphonidæ. The remarkable structure of the trophosome with its axial hydrotheca-bearing tube enveloped by the peripheral fascicle is, except in *Grammaria*, quite unknown in any other group; for this condition must not be confounded with the fasciculation of the stem which occurs in many Plumularinæ and is common in *Halecium*, *Sertularia*, *Thuiaria*, and other genera, in which the component tubes are not divisible into an axial tube which carries the hydrothecæ and peripheral tubes which are destitute of hydrothecæ.

Our investigation of the stem of *Sertularella gayi*, however, has demonstrated that this species has just as clearly defined an axial stem as any of the Perisiphonidæ of Allman, the main difference being that the hydrothecæ on the axial tube are completely hidden in *S. gayi*, while they project between the peripheral tubes and open on the exterior in the Perisiphonidæ. But even this distinction disappears when we examine the stem of *S. gayi* near the point where the axial tube emerges from the fascicled portion to continue upward as a simple monosiphonic stem. (See figs. 3 and 4.) That portion of the stem which bears the hydrothecæ answers precisely to Allman's definition of the state of affairs in the Perisiphonidæ. Here the axial tube alone bears hydrothecæ, and the latter bear exactly the same relation to the peripheral tubes as they do in *Perisiphonia*, for instance. In this figure the origin of the peripheral tubes is plainly seen at *a*, *a*, and the relation of the component parts is not in any way disturbed by dissection, as is the case in the other figures.

Only one other sertularian with a fascicled stem is available to me for dissection, and that is *Sertularella megastoma* Nutting, which shows the same features of axial and peripheral tubes and the same origin for the latter as have been described at length for *Sertularella gayi*. *Sertularella catena*, *S. lata*, *S. pinnigera*, and *S. tropica* also have fascicled stems; but my specimens of the first two are too small to admit of dissection for this purpose, and I have not seen specimens of the others.

In none of these cases does there seem to be any cross connection between the various tubes such as is found in certain of the Plumularidæ[2] nor does there seem to be any sarcodal connection except at the point of origin of each tube. The tubes seem to adhere together by virtue of the gelatinous consistency of the chitin of which their walls are formed.

(*b*) Stems with cœnosarcal canals are found in a few Sertularidæ. Morphologically these do not appear to differ appreciably from those found in the plumularian genus *Antennularia*.[3] This feature is not always apparent, even when present, and in specimens that have been poorly preserved all trace of it sometimes disappears. The best illustration that I have seen among the Sertularidæ is found in the genus *Selaginopsis*. In a new species described beyond, *S. ornata*, the cœnosarcal canals are very regular and symmetrical, there being four canals in each branch, one canal to each of the four rows of hydrothecæ, and frequent and regularly spaced cross-connections between the canals themselves form a ladder-like structure, with a round of the ladder beneath each hydrotheca. (See fig. 6.) In the main stem of this same species there is an exceedingly complex system of anastomosing canals that does not exhibit the regularity of arrangement found in the branches. (See fig. 5.)

The mode of origin of the canaliculated cœnosarc is not well understood. Allman's investigations of these canals[4] in *Antennularia* would lead one to suppose that the young colony has at

[1] *Challenger* Report, the Hydroida, Second Part, 1888, p. 32.

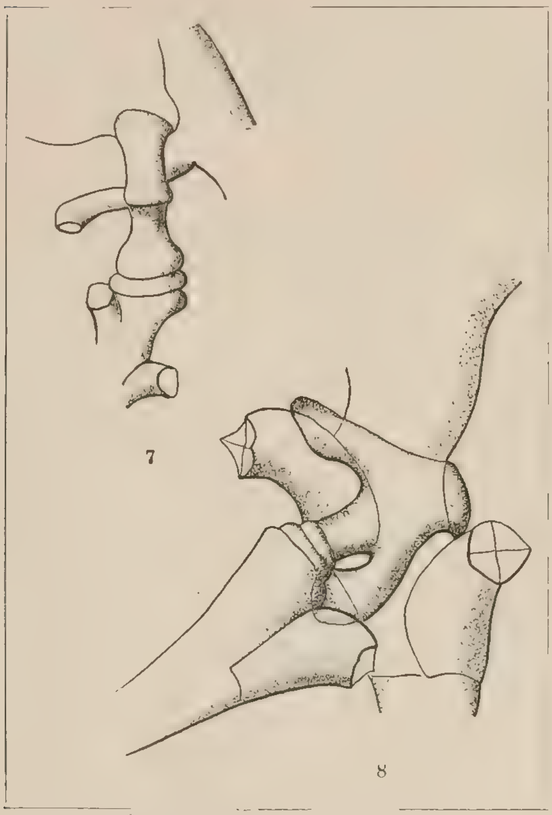
[2] See Part I, p. 5.

[3] See Part I, p. 5, fig. 1.

[4] Gymnoblastic Hydroids, 1871, p. 126. See also Part I of this work, p. 4.

first an ordinary monosiphonic stem, and that the canaliculations are formed by portions of this common cœnosarc becoming surrounded by tubes of chitin, leaving the center of the stem entirely vacant, the canals being peripheral. I am not satisfied, however, that each of these canals is surrounded by perisarc.

The Branches.—There is but little that is characteristic to be found in the branches of the Sertularidæ. Their disposition has already been discussed. They never become highly specialized to form protective structures for the passive or active defense of the gonophores, as they so often do in the Plumularidæ, where they form the curious phylactocarps. They do, however, become modified to form accessory tubes in the fascicled stem, as we have seen, and they often become tendril-like at their distal ends and clasp other branches so as to form anastomoses and sometimes a flabellate structure, as in the genus *Dictyocladium.*



THE ANASTOMOSIS OF BRANCHES IN DICTYOCLADIUM.

Fig. 7.—Tip of branch of *Dictyocladium flabellum* clasping another branch.
Fig. 8.—Another branch termination which forms lobe-like processes to secure firmer attachment to another branch.

There appear to be two methods by which the attachment of these new tendril-like branches is formed. In *D. dichotoma*, "when a branch is destined to form a union of this kind its distal extremity becomes elongated into a tendril-like continuation destitute of hydrothecæ. When this meets a neighboring branch, the end of the tendril unites with a branch, not however with any part of the surface of the branch indifferently, but, directing itself toward the orifice of a hydrotheca, it here attaches itself, its axis becoming directly continuous with that of a hydrotheca."[1] In the only other species of the genus thus far discovered, *D. flabellum* Nutting, the connection is formed much more simply. The tip of the tendril-like process grows around the branch that it meets and clasps it very much as does the tendril of a vine. (Fig. 7.) The adhesion is quite strong and permanent, and the clasping portion of the tendril may become eventually embedded in the branch so as to be hard to see, being indicated merely by a swollen area over the original point of contact. Sometimes the growing tip upon meeting a branch spreads out in lobular projections, thus increasing the extent of the surface of adhesion, as in fig. 8. This same method of joining different branches is found quite commonly in several species of *Sertularella*, especially those of a straggling habit of growth, such as *S. dichotoma* and *S. elegans.*

A merely temporary joining of the tips of hydrocladia has been reported in the case of a species of *Aglaophenia.*[2] This, however, seems to be for an altogether different purpose from the one subserved in the examples described above, and served to join two colonies, apparently for the purpose of conjugation.

I have seen no sertularians, aside from the genera *Sertularella* and *Dictyocladium*, in which anastomoses of branches occur, except perhaps as a rare abnormality.

The Hydranth.—I have been unable to find any evidence of the hydranth being studied with care in any sertularian, at least since modern histological technic became available. Without this aid, however, Louis Agassiz was able to make out most of the essential points, even of histo-

[1] Allman, *Challenger* Report, Hydroida, Second Part, 1885, p. 77.

[2] See Part I, p. 45.

logical structure, especially in the matter of the relation of the cell layers. Indeed, the more one studies his masterly work the more profound becomes the conviction that a careful and thorough use of good powers of observation and interpretation applied to living or at least fresh material is capable of yielding results that will bear comparison with those attained with the use of the most advanced technic.

The writer does not believe that any worker has done more to elucidate the entire subject of hydroid morphology, at least in the groups investigated by the older Agassiz, than has that writer himself. His is the only good description that I have been able to find of the sertularian hydranth.[1] The subject of one of his careful studies is the common *Sertularia pumila*, and he reports the following points regarding the hydranth:[2] The cœnosarc of the stem consists of two cell layers. In the stem this is of uniform thickness to a point just below the hydrothecæ, where it expands on two opposite sides, giving off cylindrical extensions which are uniform in diameter and pass through the diaphragm at the base of the hydrotheca, traverse the length of the latter, and terminate in a simple, short, conical proboscis, around which a single row of slender, tapering tentacles, usually sixteen in number, is disposed in a uniform series. The extended hydranth has no thicker ectoderm than in the main stem, but the endoderm is twice as thick, although the ectoderm and endoderm are about equal in the stem. The ectoderm of the body wall is connected in places with the hydrothecal wall by film-like projections or pseudopodial prolongations.

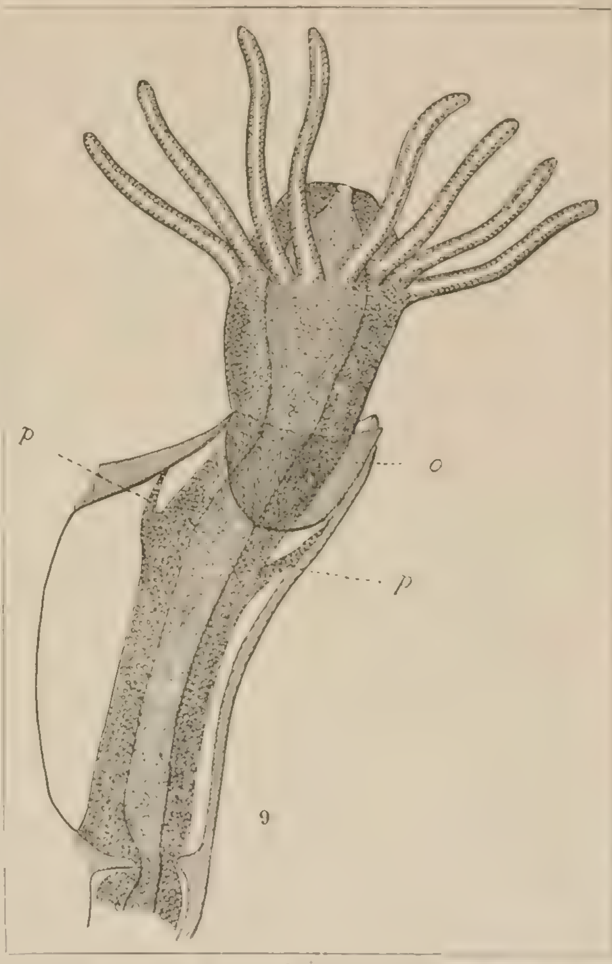


Fig. 9.—Hydrotheca and expanded hydranth of *Sertularia pumila*. *o*, operculum; *p*, *p*, protractors. The body cavity is indicated by the lighter axial portion of the hydranth.

So far as the present writer has been able to ascertain, the hydranths of all of the Sertularidæ are very similar to those of *S. pumila*, having a conical or dome-shaped proboscis and a single whorl of filiform tentacles. (Fig. 9.) It is seldom that the hydranth can be studied to advantage in preserved specimens, as they are usually either in a state of contraction or have been macerated or in some way disintegrated in the preserving fluid. If care is taken, however, it is possible to preserve expanded hydranths of shallow-water forms by the methods of killing recently devised. It seems useless to expect that we shall ever be able to study the living and expanded hydranths of deep-water species.

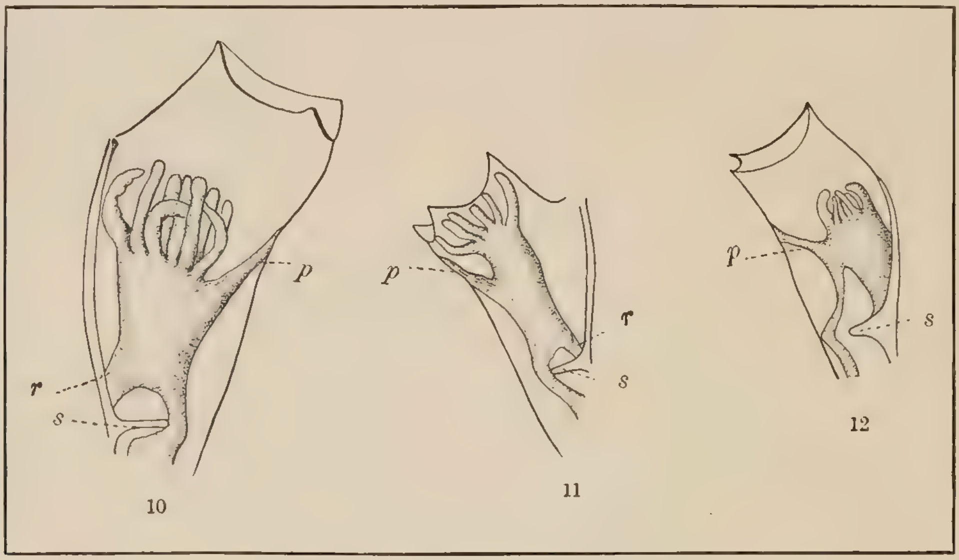
As indicated in Part I of this work,[3] there is but little difference between the hydranths of the Plumularidæ and Sertularidæ, the main distinction being in a constriction some distance below the tentacles of the former which divides the hydranth body cavity into two portions, which, however, communicate broadly.

[1] Contributions to the Natural History of the United States, IV, 1862, pp. 328–329, pl. XXXII.

[2] The terminology used by Professor Agassiz is so different from that now in vogue that I have thought it best to give the following points in more modern phraseology for the sake of lucidity.

[3] Page 9.

There are certain special features of the hydranth in this group, however, that are worthy of presentation, one of which is what may be called the protractor of the hydranth. This is a band of tissue, probably ectodermal, that originates from a point on the hydranth body about halfway between the tentacles and base on the abcauline side and passes obliquely upward and outward till it meets the inner surface of the abcauline wall of the hydrotheca, where it is firmly attached. (See figs. 10, 11, 12 *p*). It is obvious that a contraction of this band would aid in the protraction of the hydranth, and also in the initial stages of its retraction. The best examples of this structure that I have seen are in certain species of *Sertularella*, as *S. magellanica* (fig. 10), *S. levinseni* (fig. 11), and *S. megastoma* (fig. 12). Hartlaub, in discussing this structure,[1] says that it is formed before the differentiation of the tentacles and is evident upon the first withdrawal of the hydranth, and that in many species this band of attachment ("Haftzipfel") makes a mark as if it were a septum instead of a band, which divides the dorsal (abcauline) part of the hydrotheca into two chambers. That portion of the hydranth body wall to which the band is attached seems to



RETRACTED HYDRANTHS, SHOWING PROTRACTORS.

Fig. 10.—*Sertularella magellanica*. *p*, protractor; *r*, retractor; *s*, septum.
Fig. 11.—*Sertularella levinseni* (lettering the same).
Fig. 12.—*Sertularella megastoma* (lettering the same).

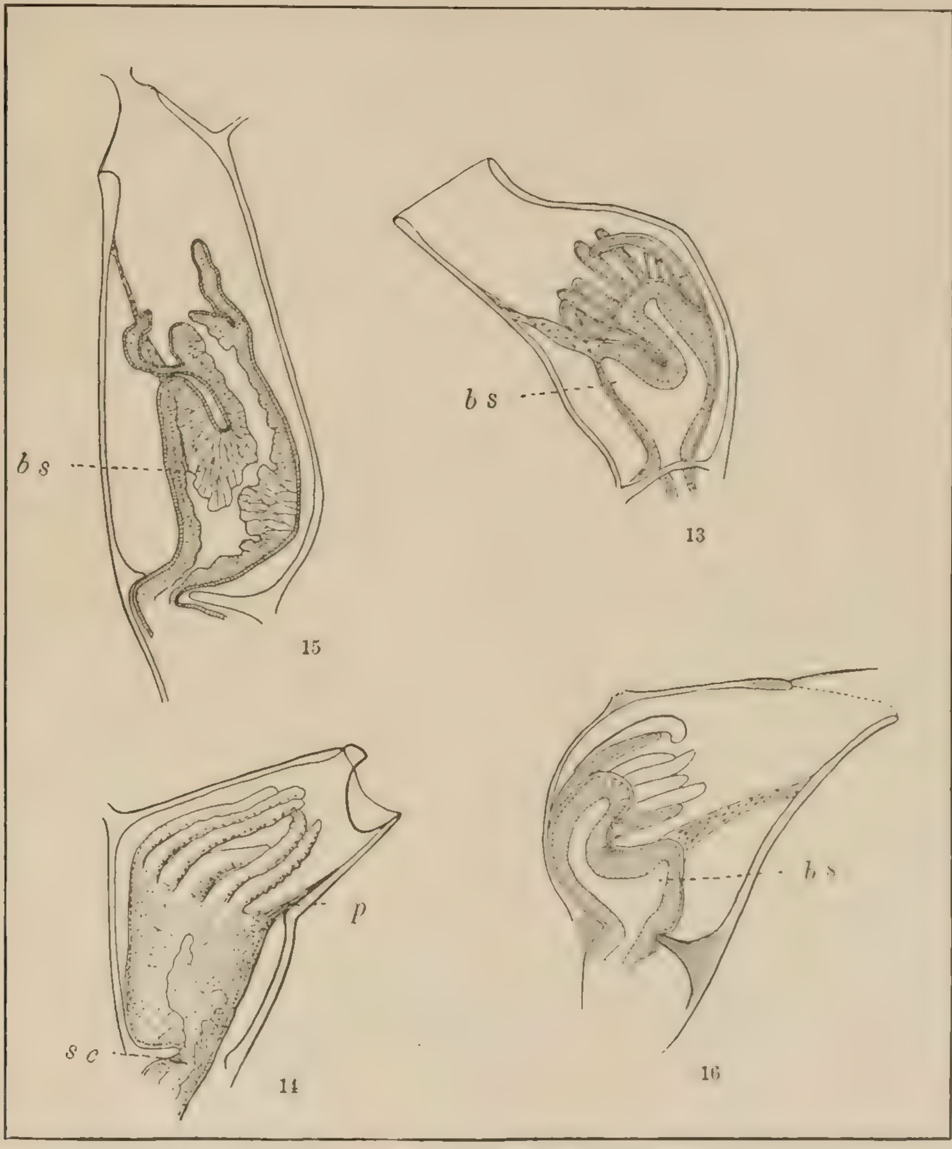
be stretched outward into a hernia-like protuberance which contains a sack-like divarication of the hydranth body cavity. To this latter Hartlaub has given the name "Blindsack." (Fig. 13, *b s.*)

In the material at my disposal it is difficult to ascertain the relationships of the various parts in the proximal end of the hydranth and bottom portion of the hydrotheca. In many species of *Sertularella* the septum at the bottom of the hydrotheca extends more than halfway across from the adcauline to the abcauline side, leaving an aperture that is unsymmetrically placed, being on the abcauline portion of the bottom of the hydrotheca. The connection between the hydranth and the sarcode of the stem passes through this aperture. (Fig. 14 *s c.*)

It appears that a large portion of the bottom of the hydranth is permanently attached to the septum, and this part of the hydranth corresponds to the foot of the hydra. At times this portion of the foot seems to be muscle-like in function and to work in opposition to the protractor mentioned above. It thus serves functionally as a retractor muscle, and secures its point of resistance on the upper side or face of the septum. This condition of affairs seems to be common in those species that have a well-developed protractor on the abcauline side, and this fact would seem to support the view that it works functionally in opposition to the latter.

[1] Revision der Sertularella-Arten, 1900, pp. 10, 11.

The blind sack is very well shown in *Abietinaria abietina* (figs. 13–16), where it is perfectly evident that it is a hernia-like protuberance from the body wall of the hydranth which is attached to the hydrothecal wall by a band of ectodermal tissue. That the structures just described are very widely distributed among the Sertularidæ is proved by the fact that I have found them in one or more typical species of the following genera: *Thuiaria*, *Sertularia*, *Synthecium*, *Hydrallmania*, *Selaginopsis*, *Diphasia*, *Abietinaria*, *Dictyocladium*, and *Sertularella*. In *Sertularia pumila* there are apparently two protractors on opposite sides of the hydranth. (See fig. 9, p. 9.) These may be the structures referred to by Louis Agassiz as "film-like projections or pseudopodial prolongations" by which the ectoderm of the body wall is connected with the wall of the hydrotheca. A still more striking case in which two protractors are present is found in *Diphasia digitalis*. (See fig. 17.)



LONGITUDINAL SECTIONS OF RETRACTED HYDRANTHS.

Fig. 13.—*Abietinaria abietina*. *b s*, blind sack.
Fig. 14.—*Sertularia versluysi*. *s c*, sarcodal connection between the hydranth and the stem; *p*, protractor.
Fig. 15.—*Thuiaria robusta*. *b s*, blind sack.
Fig. 16.—*Abietinaria traski*. *b s*, blind sack.

Hartlaub[1] says that he has seen the blind sack filled with food particles, and suggests that it may function as the stomach of the hydranth. It is not improbable that it may share this function with the rest of the body cavity of which it is merely a divarication, but I see no proof that it assumes the full burden of the digestive function. This writer also calls attention to the fact that the adcauline wall of the sack has an endodermal lining of columnar epithelium like that of the body cavity in general, while the abcauline wall is lined with ordinary endodermal cells. (Fig. 15.) He suggests that the blind sack may have something to do with the renewal of the hydranth, but does not support this suggestion with any definite proof. He doubtless infers that the undifferentiated endoderm of the sack must be capable of some function other than that performed by the columnar epithelium, and this may have given rise to the suggestion regarding the connection between the blind sack and regeneration. He says that this structure is absent from the Campanularidæ in general, and believes that it constitutes a good systematic character by which that group may be separated from the Sertularidæ. It is doubtless true that this important structure has been altogether too much neglected by systematists. The present writer, however, desires to make a critical study of it in connection with the other groups before adopting it as a criterion for the division of family groups.

In several species of *Sertularella*, as *S. dichotoma*, and in the *Desmoscyphus* group of *Sertularia*, there is an internal ridge on the abcauline wall of the hydrotheca that corresponds to the intrathecal ridge in the Plumularidæ and appears to be for the firmer anchorage of the protractor. (Fig. 20, *r*.)

But one other feature pertaining to the hydranth need be discussed here, and that is the structures that are supposed to be muscles for the closing of the operculum. I have been unable to find them as a constant feature in any one species. Hartlaub figures them as present in *Sertularella gayi*[1], but they are certainly not at all constant in that species.

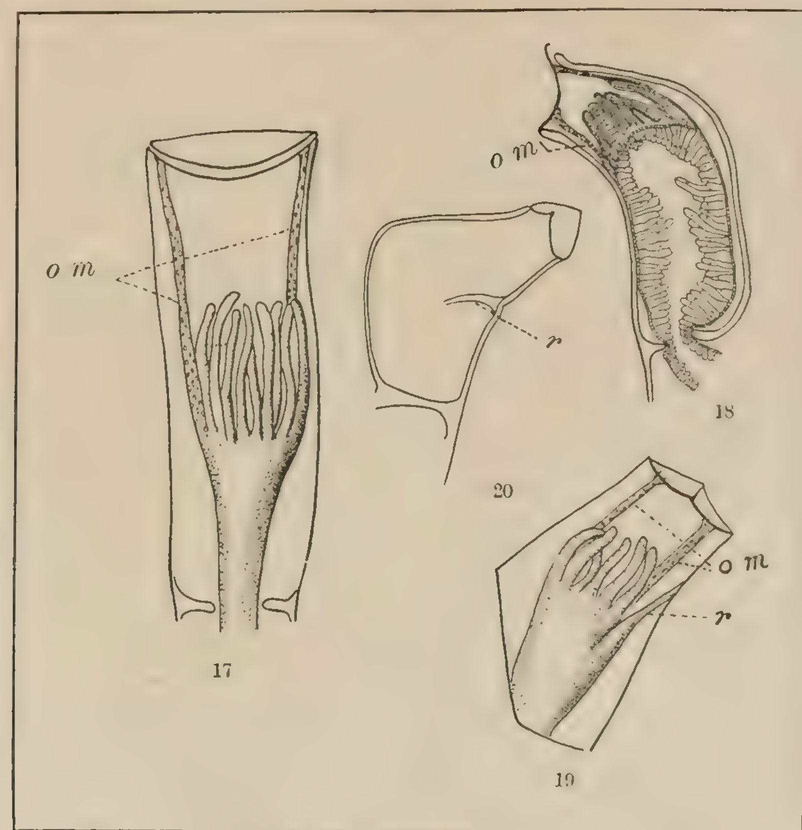
While I have found a number of cases which I at first was inclined to consider as opercular muscles, they were found on closer examination to end on the margin of the hydrotheca, and not to reach the operculum at all. In such cases it is reasonable to interpret the structures rather as protractors than as opercular muscles. (See figs. 17–19, *o m*.) In other cases the muscular bands end freely in the upper part of the hydrothecal cavity, as if they had been torn from their attachments. These may be opercular muscles, but until they are found connected directly and definitely with the operculum the writer believes that it is wisest to refrain from ascribing to them a definite function in connection with the opercula. It must be remembered that the hydranths at times send forth all sorts of projections from the ectoderm toward the hydrothecal walls, and doubtless these are occasionally attached to the operculum. But we have as yet no evidence that such attachments are permanent or constant, as are the protractors described above. Hartlaub, who copied the figure mentioned above from Allman, is not at all convinced that there are such things as retractors of the opercula, and suggests that Allman was mistaken in his interpretation, as it often happens that one or more tentacles of a retracted hydranth remain with their tips attached to the opercula. The present writer has not seen instances of this. In one case (fig. 18) there is a structure that looks a good deal like a retractor of the operculum. The figure was taken from a section, and it appears that the long sarcodal process from the hydranth is directly attached to the operculum, but it may not be a retractor at all, but simply one of the many processes thrown out by the hydranth under certain conditions, particularly when the latter is about to begin the process of disintegration. The mechanical necessity for retractors to the operculum does not seem at all evident. The valves are so arranged that they would naturally fall back into place upon the retraction of the hydranth, and this action is probably aided and hastened by the elasticity of the chitinous material of which they are composed.

In size the Sertularian hydranth does not differ appreciably from that of the Plumularidæ, although they average somewhat larger. Although they are almost always retracted in preserved specimens they are still available for study, while those of the plumularians are usually entirely absent in specimens preserved in alcohol or formalin. Hartlaub says that the proboscis is

[1] Revision der Sertularella-Arten, 1900, p. 11.

trumpet-shaped in well-preserved specimens, but I have not been able to verify this observation; and those specimens that I have seen alive, as *S. pumila* and *S. cornicina*, have invariably had true conical proboscides like those of the Plumularidæ. I have also seen the expanded living hydranths of *Sertularella polyzonias* and *Thuiaria argentea*, and here, too, the proboscis was conical.

The Hydrothecæ.—All of the Sertularidæ being colonial forms the individuals, as already indicated, are subordinate to the colony as a whole. None of the hydrothecæ in this group are furnished with pedicels of any considerable length,[1] and the sessile condition has resulted in a true bilateral symmetry that seems to be universal in this family and the Plumularidæ. The



THE SO-CALLED "OPERCULAR MUSCLES."

Fig. 17.—*Diphasia digitalis.* *o m*, opercular muscle.
Fig. 18.—*Thuiaria sp.* *o m*, opercular muscle.
Fig. 19.—*Sertularella megastoma.* *o m*, opercular muscle; *r*, retractor muscle.
Fig. 20.—Hydrotheca of *Sertularia versluysi*, showing intrathecal ridge at *r*.

reason for this seems to be that the stems and branches upon which the hydrothecæ are sessile are in general more or less erect, or at least not horizontal in position. The normal posture of the hydranth is erect or nearly so, the mouth being directed upward.

Hence the axis of the hydrotheca forms an acute angle with that of the stem or branch upon which it grows, and as a result the adcauline side tends to be shorter than the abcauline. In other words the posture of the hydranth determines the inclination of the hydrotheca in the Sertularidæ, while the flexibility of the pedicel in the Campanularidæ permits the hydranth to be directed upward without disturbing the radial symmetry of the hydrotheca. It thus comes about that the sertularian hydrotheca tends to assume a symmetry that is bilateral rather than

[1] If the *Sertularella solitaria* described in this work (see Plate XX, figs. 10, 11) is adult, as seems altogether likely, it would be an exception to this statement, as the hydrothecæ in this species have pedicels of considerable length.

radial. Of course this symmetry is often interfered with, particularly where the hydrotheca has a curve that is not in the vertical plane, as is the case with many species in which the hydrothecæ curve forward as well as outward and upward, as *Sertularella pinnata* (Plate XXI, fig. 10), and *S. allmani* (Plate XVIII, fig. 3). Again the implantation of the hydrotheca may be upon the front rather than upon the sides of the stem, and thus we have a difference between the front and back, as well as between the adcauline and abcauline sides of the hydrotheca as in the case of *Hydrallmania falcata* (Plate XXXVIII, fig. 1), and in the *Desmoscyphus* group of *Sertularia* (Plate I, fig. 7). That the bilateral symmetry is the result of the mechanical causes referred to is rendered all the more probable from the fact that the primary hydranth of many species of sertularians is seen to be radially symmetrical if observed at a very early stage in its developement. If we examine very young specimens of *Sertularella rugosa*, for instance, we find that the primary hydranth is at first mounted on a distinct pedicel like that of a campanularian, and is radially symmetrical (see fig. 21).

It very shortly, however, becomes bilaterally symmetrical by the production of a protuberance on one side of its base, and this protuberance shortly gives rise to a second hydrotheca. This seems to indicate that radial symmetry is the original condition and bilateral symmetry a later acquisition in the group, brought about by mechanical causes relating to the necessity of adjusting the sessile hydrothecæ to the hydrocaulus. The condition of affairs described above is true only of those species having alternate hydrothecæ. When they are strictly opposite, the two terminal hydrothecæ are produced together, and hence such species produce primitive pairs of hydrothecæ that are necessarily bilateral.

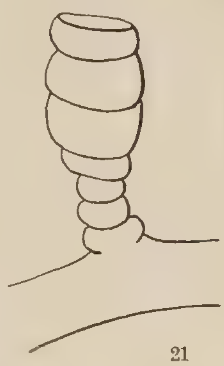

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Fig. 21.—Very young hydrotheca of *Sertularella rugosa*, showing radial symmetry.

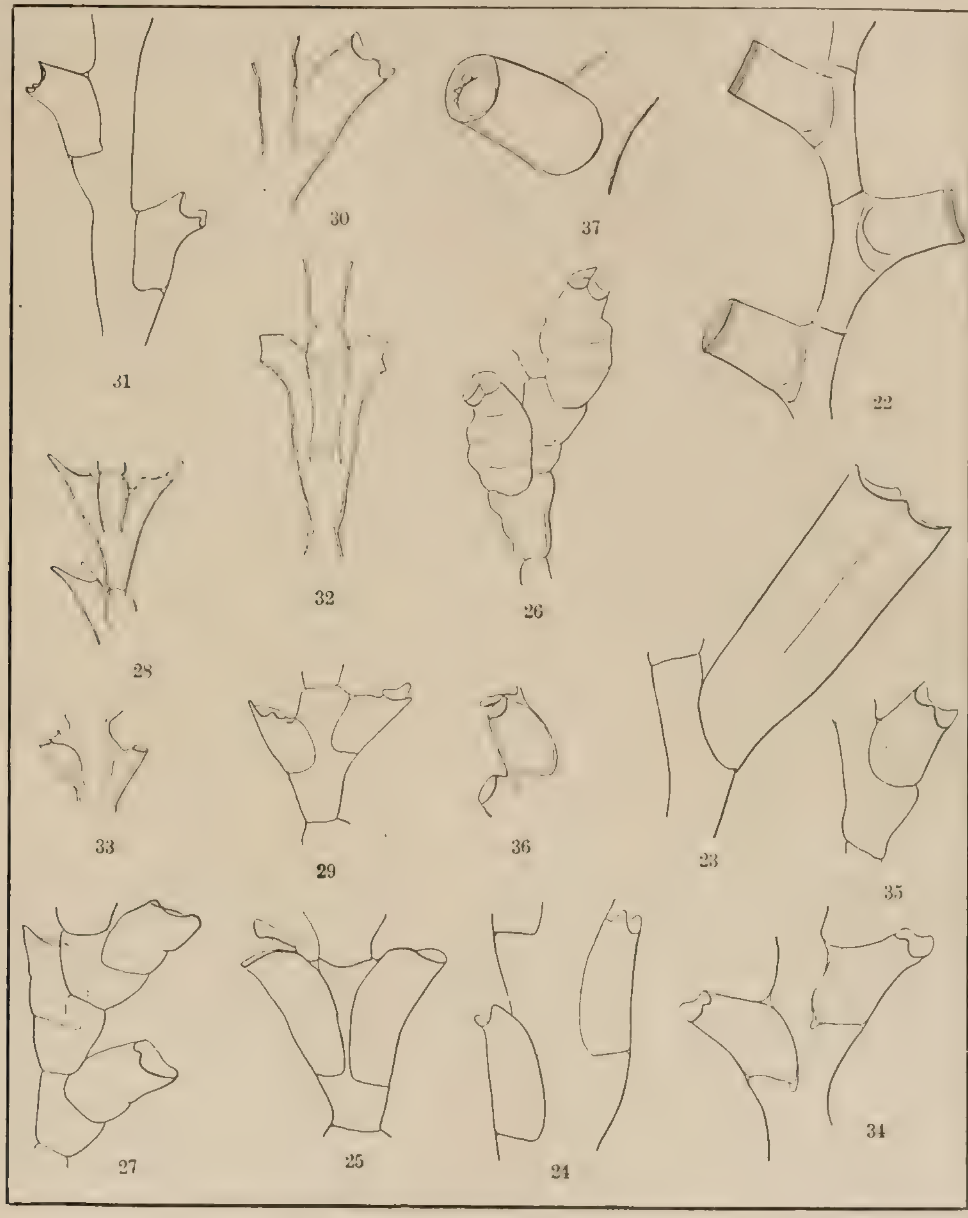
In almost all species of sertularians the several hydrothecæ of the mature colonies are substantially alike, the only notable exception being in the genus *Pasythea*, where the hydrothecæ are in groups of pairs and no two pairs in a given group are alike either in form or size (see Plate XIII, fig. 4).

With the exception of the genus *Selaginopsis* all of the American sertularians conform to the bilateral plan not only in regard to the shape of the individual hydrothecæ, but also in the arrangement of the hydrothecæ on the stem and branches (see fig. 32). This is due to the fact that the hydrothecæ are arranged in two usually opposite rows. If a branch of such a species should be split vertically from front to back it would be divided into two equal and symmetrical parts. When the hydrothecæ are alternate, these two parts would be similar but not symmetrical. The same is true in *Hydrallmania*, where the hydrothecæ are all in a single row but have their distal ends bent alternately to the right and left. In *Selaginopsis* the hydrothecæ are arranged in more than two rows, in one case, *S. decemserialis*, there being ten longitudinal rows. In this genus there is not only the regular vertical arrangement of hydrothecæ, but a spiral arrangement as well.

The hydrothecæ vary greatly in different species both in size and shape. In general they are much deeper in proportion to their diameter than those of the Plumularidæ. Perhaps the most common form is more or less tubular, with the distal end bent to one side, as in *Sertularia pumila*. Most species of the genera *Sertularia*, *Synthecium*, and *Thuiaria* have hydrothecæ of this type, which reaches its most perfect form in such species as *Synthecium rectum* (Plate XLI, fig. 2).

Sometimes the tube is not bent, and the hydrotheca becomes an almost perfect cylinder, as in *Sertularella formosa* (fig. 22) or *Synthecium cylindricum* (Plate XLI, fig. 7). Again it may be so short, truncated, and expanded at the base as to resemble the frustum of a cone, as in *Sertularella hartlaubi* (Plate XXVII, fig. 5). The cylindrical hydrothecæ, like all others among the Sertularidæ, vary greatly in the extent to which they are immersed in the hydrocaulus, sometimes being attached to the latter by their extreme base only, as in *S. quadrata* (fig. 23); or it may be immersed to the margin all around, as in *Sertularella distans* (Plate XIX, fig. 6) or *Sertularella lata* (Plate XVIII, fig. 10). Every possible intergradation between these two extremes can be found. Sometimes great variation occurs in a single colony, as in the case of *Sertularella magellanica*

(Plate XXIV, figs. 6, 7), where the hydrothecæ are almost entirely exserted on the proximal part and more than half of their adcauline wall is adnate in the distal parts of the colony. This condition, however, is quite exceptional, the extent of immersion being much more constant as a



TYPES OF HYDROTHECÆ OF SERTULARIANS.

Fig. 22.—*Sertularella formosa*.
Fig. 23.—*Sertularella quadrata*.
Fig. 24.—*Thuiaria robusta*.
Fig. 25.—*Diphasia fallax*.
Fig. 26.—*Sertularella rugosa*.
Fig. 27.—*Sertularella pinnata*.
Fig. 28.—*Sertularia operculata*.
Fig. 29.—*Abietinaria greenei* (showing teeth).
Fig. 30.—*Sertularella tricuspidata*.
Fig. 31.—*Sertularella filiformis*.
Fig. 32.—*Sertularia cornicina*.
Fig. 33.—*Abietinaria greenei* (smooth margin).
Fig. 34.—*Abietinaria greenei* (toothed margin).
Fig. 35.—*Sertularella tricuspidata*.
Fig. 36.—*Thuiaria gigantea*.
Fig. 37.—*Sertularella formosa*.

(Figs. 22, 23, 33, 36, and 37 are only half as much magnified as the others.)

rule. The departures from the cylindrical form of the hydrothecæ are almost innumerable, but can most of them be reduced to the following types:

(*a*) *Flask-shaped*, in which the basal part is swollen, and the distal part constricted and often bent. Illustrated by many species of *Thuiaria*, such as *T. robusta* (fig. 24), *T. polycarpa* (Plate

VIII, fig. 8), and *T. immersa;* in several species of *Sertularia*, as *S. desmoides* (Plate III, fig. 2); and in *Selaginopsis*, as *S. cylindrica* (Plate XXXIX, figs. 7 and 8).

(*b*) When the neck of the flask becomes elongated and curved to one side, we have what may be called the "*bottle-shaped*" hydrotheca, which is characteristic of the genus *Abietinaria* as used in this work and well shown in such species as *A. abietina* (Plate XXXII, fig. 1), *A. variabilis* (Plate XXXII, fig. 5), *A. gracilis* (Plate XXXV, fig. 2). The bottle-shaped hydrothecæ intergrade with the flask-shaped hydrothecæ on the one hand and the triangular forms on the other.

(*c*) *Pitcher-shaped* hydrothecæ are found in certain species of *Diphasia*, as *D. fallax* (fig. 25), *D. rosacea* (Plate XXVIII, fig. 4), *D. paarmanni* (Plate XXXI, fig. 5), and occasionally in *Sertularella*, as in *S. episcopus* (Plate XXVI, fig. 7). Such forms are produced by having the margin of the hydrothecæ expanded and sinuous on the abcauline side so as to resemble the lip of a pitcher.

(*d*) *Barrel-shaped* hydrothecæ are round, with both distal and proximal ends slightly diminished in diameter, and both upper and lower profiles convex. They are more nearly radial in symmetry than most of the others, and are found almost exclusively in the genus *Sertularella*, as *S. rugosa* (fig. 26), *S. areyi* (Plate XVII, fig. 6), *S. geniculata* (Plate XVI, fig. 2), *S. patagonica* (Plate XVI, fig. 3). This form is usually provided with a square collar, which interferes with the symmetry of the "barrel." In *S. tanneri* (Plate XVI, fig. 1), a very large and beautiful hydrotheca is seen which, in some instances at least, attains almost a perfect barrel shape.

(*e*) When this latter type is greatly elongated a slender terete outline is produced, which gives the typical fusiform hydrotheca, which is very rare, illustrated by *Sertularella fusiformis* (Plate XX, fig. 3), and less perfectly by *S. gigantea* (Plate XIX, fig. 7).

(*f*) In a few cases the axis of the hydrotheca is straight and the base expanded, while the diameter gradually decreases toward the distal end. Thus a *conoid* form is produced, which is quite rare. Illustrated by *Abietinaria alexanderi* (Plate XXXV, fig. 5). If the distal two-thirds of such a hydrotheca were cut off, we would have such a form as *Sertularella hartlaubi* (Plate XXVII, fig. 5).

(*g*) Triangular hydrothecæ. In a few cases hydrothecæ are triangular in outline as viewed from the front, being bounded by three approximately straight sides. This occurs in the *Desmoscyphus* group of *Sertularia* as *S. versluysi* (Plate I, fig. 9), in which the two inner sides of a pair of hydrothecæ are contiguous and pressed together so as to form a straight line, and the aperture at the supero-lateral angle is very small. The triangular outline is also approached in *Abietinaria traski* (Plate XXXIII, fig. 10).

(*h*) Perhaps the rarest form of hydrothecæ is one that approaches a parallelopipedon in shape, having a quadrate cross section and four parallel sides. This form is well shown in *Sertularella quadrata* (fig. 23), and in *S. cylindritheca* (Plate XIX, fig. 4). A combination of this form and the barrel-shaped hydrotheca is found in *Sertularella rugosa*, where the upper part of the hydrotheca is modified in shape so as to be square in section, while the remainder is barrel-shaped. The extent of immersion varies greatly in most of these types, but is probably most complete in some species of *Thuiaria*, as *T. immersa* (Plate IX, fig. 4), in which the entire hydrothecal margin is sunk to the general level of the hydrocaulus so as to be flush with it all around.

There is in general a pretty close adherence to type in the hydrothecæ of a given species, the most notable exception being the case of *Pasythea quadridentata* (Plate XIII, fig. 4), in which the hydrothecæ are arranged in groups of pairs, no two pairs in a group being alike, the upper pair being smaller than the lower and more or less quadrate in outline. A slight approach to the same condition is found in the case of *Thuiaria tubuliformis*. On Plate XI, fig. 2, for instance, the lowest pair of hydrothecæ is much broader from margin to margin than the next pair. Another and more evident example is found in *Sertularia mayeri* (Plate V, figs. 1, 2), where the hydrothecæ on the basal part of the stem are much longer than those on the distal part, and are bent abruptly outward, forming nearly a right angle at their middle portion.

The ornamentation of the hydrothecal surface in the Sertularidæ is effected mainly by annulations, striæ, and reduplications of the margins, and each of these is confined mainly to the genus *Sertularella*. The rugosities are sometimes confined to the free part of the adcauline side, as in *Sertularella gayi* (Plate XIV, fig. 1), *S. conica* (Plate XV, fig. 1), and *S. catena* (Plate XV, fig. 3). Often they are continued entirely around the hydrothecal wall as in the *rugosa* group. Ordinarily this latter condition is associated with the quadrate neck, but a notable exception is found in a new species with very large barrel-shaped hydrothecæ, *S. tanneri* (Plate XVI, fig. 1). Annulations differ from rugosities in being finer and more sharply cut, although the terms are often apparently used as if they were interchangeable. A notable instance of this style of ornamentation is found in *Diphasia tropica* (Plate XXX, fig. 1), in which the entire hydrothecal wall is marked with very fine but greatly raised annulations, the outer surface of which is so fine as to be linear. If the bottoms of a pile of very thin dinner plates were removed, and the remainder of the plates fitted to a cylinder, they would represent fairly well the structure of these annular ridges. There is but one species that I know of with longitudinal markings like ribs or costæ, and that is *Sertularella areyi* (Plate XVII, fig. 6). Striæ are simply very fine annulations running in a parallel direction. These are well shown in *Sertularella quadrata* (Plate XV, fig. 5). Under favorable conditions of illumination the entire surface of the hydrothecal walls is seen to be marked by these fine, closely set lines.

The hydrothecal aperture is largely determined by the shape of the margin and the marginal teeth. Most commonly it is round or oval in shape (fig. 33); often it is quadrate, as in the *rugosa* group of *Sertularella*, or in *S. quadrata;* rarely it is lunate, as in *Thuiaria diffusa* (Plate X, fig. 2). The margin is often more or less everted, as if rolled outward, as in the case of *Synthecium tubithecum* (Plate XLI, fig. 1); or it may be expanded, as in *Sertularella pinnata* (fig. 27) and *S. elegans* (Plate XXIV, fig. 1); or sometimes it is contracted, as in *Sertularia versluysi* (Plate I, fig. 7) or *Abietinaria traski* (Plate XXXIII, fig. 10).

The ornamentation of the hydrothecal margin is sometimes in the form of a distinct narrow band or rim, as in *Sertularella formosa* (fig. 22), *Synthecium rectum* (Plate XLI, fig. 2), or *Sertularella distans* (Plate XIX, fig. 6); or it may be effected by means of closely approximated circular striations, as in *Abietinaria alexanderi* (Plate XXXV, fig. 5) or *Synthecium marginatum* (Plate XLI, fig. 3).

The reduplication of the margin often seen in the Sertularidæ, but displayed best in *Halecium*, seems to be produced by periodic and successive stages in the growth of the hydranth, or, as Levinsen seems to have shown, by the successive renewal or regeneration of the hydranth. In this latter case each reduplication represents a complete regeneration of the hydranth occupying the hydrotheca. These reduplications produce the appearance of a number of false margins below but parallel with the functional one. There are many illustrations of this among American forms, such as *Synthecium tubithecum*, *Sertularella quadrata*, *S. dentifera* (Plate XXV, fig. 2), and *S. gigantea*.

The marginal teeth of the hydrothecæ, whatever their origin or function, form a character of the very greatest importance from the standpoint of the systematist, and are therefore worthy of careful consideration. They consist of more or less evident prominences projecting from the margin and following in general the direction of the hydrothecal walls from which they spring. They vary greatly in size, form, and position. Many hydrothecæ are entirely destitute of marginal teeth, in which case the margin is defined as even, plain, or sinuous.

The even margin is common in *Thuiaria* (fig. 36), *Selaginopsis*, and *Abietinaria*, and is present in all species of *Synthecium* thus far described. It is only exceptionally present in *Sertularia*, as *S. desmoides* (Plate III, fig. 1), and in *Sertularella*, as in *S. formosa* (fig. 22) and *S. hartlaubi*. The sinuous margin is found in several species of *Diphasia*, as in *D. rosacea*, in which the margin exhibits broad and low undulations, which are not sufficiently pronounced to be called teeth. This form of margin often produces the effect of the mouth of a pitcher, and is usually found in connection with the "pitcher-shaped" hydrothecæ. It is often very difficult to decide whether a given margin is sinuous or toothed because the two completely intergrade.

Again, it often happens that an oval aperture seems to be pinched, as it were, on opposite sides at the ends of its long diameter. This produces what is known as the angulated margin, such as is found in several species of *Selaginopsis*, as *S. pinnata* (Plate XXXIX, fig. 6), and is very difficult to distinguish from certain margins with two teeth, when looking directly into the aperture, as in *Thuiaria tenera* (Plate XI, fig. 11). A lateral view of the same hydrotheca, however, discloses the fact that the margin is bidentate (Plate XI, fig. 10).

Among American species of Sertularidæ the number of teeth never exceeds four in normal hydrothecæ. There are several Australian forms, however, in which the dental armature is much more complicated, there being sometimes as many as sixteen, as in *Sertularia acanthostoma* Bale.[1] In designating the position of the teeth it is customary to speak of those on the side of the margin nearest the hydrocaulus as "adcauline," those on the opposite side as "abcauline," and any situated about midway between these points as "lateral."

Hydrothecæ with a single marginal tooth are rare, the examples being practically confined to the genus *Thuiaria*, as *T. elegans* (Plate VII, fig. 4). In this case, however, there is a very large abcauline tooth and the adcauline margin is so closely appressed to the hydrocaulus that it is difficult to tell whether there is an adcauline tooth or not. In *T. kurilæ* (Plate IX, fig. 1) there is a single very conspicuous adcauline tooth.

The bidentate margin is very common in the Sertularidæ, and is in general characteristic of the genus *Sertularia*. The teeth are usually lateral and opposite, and appear often as if a tubular hydrotheca had been beveled on the adcauline and abcauline sides of the distal end. These opposite lateral teeth are often quite unequal in size, as in the case of *Thuiaria argentea* (Plate XII, fig. 4) and *T. diffusa* (Plate X, fig. 2). But in many other cases they are proximally of equal size, as *Thuiaria plumulifera* (Plate IX, fig. 9). Sometimes the two teeth are both abcauline and very conspicuous, as in *Sertularella episcopus*, *Sertularia operculata* (fig. 28), or *Abietinaria greenei* (figs. 29, 34). In this latter case we have perfectly even margins on the hydrothecæ on one part of the colony, and two strong marginal teeth on those of another part of the same colony.

Three marginal teeth are found in many species of *Sertularella*, and a few in *Sertularia* and *Thuiaria*. In *Sertularella* they are usually equal in size and equidistant from each other, and vary from almost imperceptible prominences on the margin to pronounced pointed teeth that form a very striking ornamentation, as in *Sertularella pinnata* (fig. 27), *S. tricuspidata* (figs. 30, 35), and *S. filiformis* (fig. 31). Rarely there is a small adcauline tooth and two large and conspicuous abcauline teeth, as *Sertularella turgida* (Plate XXII, fig. 3). In the genera *Sertularia* and *Thuiaria* the three teeth, when present, differ greatly in size, there being two large opposite lateral teeth, and one very small adcauline tooth, as in *Sertularia rathbuni* (Plate III, fig. 9), and *Thuiaria tubuliformis* (Plate XI, fig. 5).

Four marginal teeth are found in the genus *Sertularella* alone, and their variations are about the same as those just mentioned in connection with three-toothed forms. They are often so low and inconspicuous as to be difficult to make out, as in *S. lata* (Plate XVIII, fig. 10), and *S. pinnigera* (Plate XIX, fig. 3). These very low teeth are apt to be associated with practically complete immersion of hydrothecæ, as shown in the figures just cited. In only a few cases are they very pronounced and conspicuous, and then they are apt to be unequal in size, the abcauline pair being the larger, as in *S. contorta* (Plate XVIII, fig. 7).

It has been suggested by Hartlaub that the hydrotheca is lined by an epithelial membrane.[2] In a certain species of *Sertularella* this writer found a membrane with a large central opening stretched across the aperture of the hydrotheca, as a velum is stretched across the bell opening of a medusa. From a study of this specimen, and also from the fact that empty hydrothecæ often present certain shrunken structures fastened around the inside of the margin, and from the presence in many species of a ring-like line just below the margin and running around the hydrotheca, this writer suggests that the hydrothecæ have a thin epithelial lining which sometimes discloses itself in empty hydrothecæ in the form of a shallow funnel-like sack attached to the hydrotheca along the ring-like line referred to.

[1] Australian Hydroid Zoophytes, 1884, p. 85, pl. IV, figs. 7 and 8. [2] Revision der Sertularella-Arten, 1900, p. 11.

In the examination of serial sections of hydrothecæ I have been unable to find any epithelial structure of this sort. It is probable, however, that there is at times a chitinous lining to the hydrothecal chamber that may be separated from the hydrothecal wall through shrinkage. If we remember the origin of the hydrotheca and its relation to the young hydranth a very probable explanation suggests itself. The hydrotheca is formed as an excretion from the epidermal cells of the budding hydranth which fills the cavity of the hydrotheca until the latter has attained its full size and final form. An examination of the hydrothecal walls under high magnification and in sections shows that they are laminate, as if formed by the deposition of successive thin layers of chitin. When the hydranth nears maturity it withdraws from contact with the hydrothecal walls, the separation proceeding from below upward, the top of the hydranth being the last to become separated from the hydrotheca. The last area of union, therefore, is annular and near the top of the hydrotheca just beneath the margin. Thus it will be seen that the last delicate layer of chitin would line the hydrotheca up to a ring-like band which may be somewhat thicker than the rest because here the secreting surface has been longest in contact with the hydrotheca. Under certain conditions it is entirely conceivable that this thin membrane should become separated from the hydrothecal wall, of which it is really a part, by shrinkage, especially in preserved specimens. In this case it would be apt to remain attached to the annular area longer than to other portions on the hydrothecal walls, and we would then have exactly the appearance which attracted the attention of Hartlaub. The lining is not epithelial, however, in a strict sense, and does not belong properly to any one of the cell layers, because it is not composed of cells or of modified cells. On the contrary, it is histologically and morphologically merely the innermost of a number of layers excreted by the ectoderm of the hydranth and forming the hydrothecal walls.

The Operculum.—This is a structure of great systematic importance that has been made especially prominent through the careful work of Prof. G. M. R. Levinsen, and his admirable presentation of the results of his investigations.[1]

One of the earliest specific accounts of the operculum among the Sertularidae is found in Louis Agassiz's Contributions to the Natural History of the United States.[2] This author, in describing the growth of the hydranth, says: "And the body retracts altogether from the calycle, after having completed the formation of a bivalve-like operculum." "When the hydra protrudes from its calycle for the first time it pushes aside the operculum, yet the latter may remain adherent for some time, but evidently for no particular purpose."

A still earlier mention of the operculum, in the genus *Sertularella*, is found in a work written in 1857 by Joshua Alder,[3] who notes the presence of the four-parted operculum in *S. rugosa* and *S. tenella*, but seems not to have observed it in *S. polyzonias* nor in *S. tricuspidata*, both of which species were known to him. In 1868 Hincks, in his British Hydroid Zoophytes, mentions the opercula in the genera *Sertularella*, *Diphasia*, and *Thuiaria*, but does not seem to have found it in *Sertularia*. Allman, in his *Challenger* Report, the Hydroida, Second Part, 1888, gives as a part of his definition of *Sertularia* "orifice with or without an operculum" (p. 50), and has this to say regarding the operculum: "The valves in all these cases are so thin and perishable that it is only in recent or exceptionally well-preserved specimens we can hope to meet with them, a fact which in itself deprives the distinctions derived from them of that practical value which ought, if possible, to be found in all well-selected systematic characters" (p. 51). This author also adopts a "lid-like operculum formed by a single valve" as a character of the genus *Diphasia*, and notes that two species of his genus *Desmoscyphus*, *D. pectinatus* and *D. acanthocarpus*, possess opercula.

[1] Om Fornyelsen af Ernæringsindividerne hos Hydroiderne; Videnskabelige Meddelelser fra den naturhistoriske. Forening i Kjobenhavn., 1892; Copenhagen, 1892.

Meduser Ctenophorer og Hydroider fra Grönlands Vestkyst tilligemed Bemærkninger om Hydroidernes Systematik; idem., Copenhagen, 1893.

[2] Vol. IV, 1862, p. 331.

[3] A Catalogue of Zoophytes of Northumberland and Durham, Newcastle-on-Tyne, 1857, p. 23.

In 1890 Marktanner-Turneretscher[1] used the operculum in giving the diagnostic features of the genera *Sertularella*, *Calyptothuiaria*, *Monopoma*, *Diphasia*, and *Dynamena*. In the present work *Calyptothuiaria* is included in the genus *Sertularella* and *Monopoma* in *Abietinaria*.

As before indicated, it remained for Levinsen to make a systematic and comprehensive study of the operculum in various groups, and this he has done with the painstaking care that is characteristic of our Scandinavian fellow-zoologists.

The following points are quoted direct from his systematic discussion of the Sertularidæ[2] and translated by Mr. J. H. Paarmann, who studied the operculum in connection with a thesis for the master's degree in the State University of Iowa:

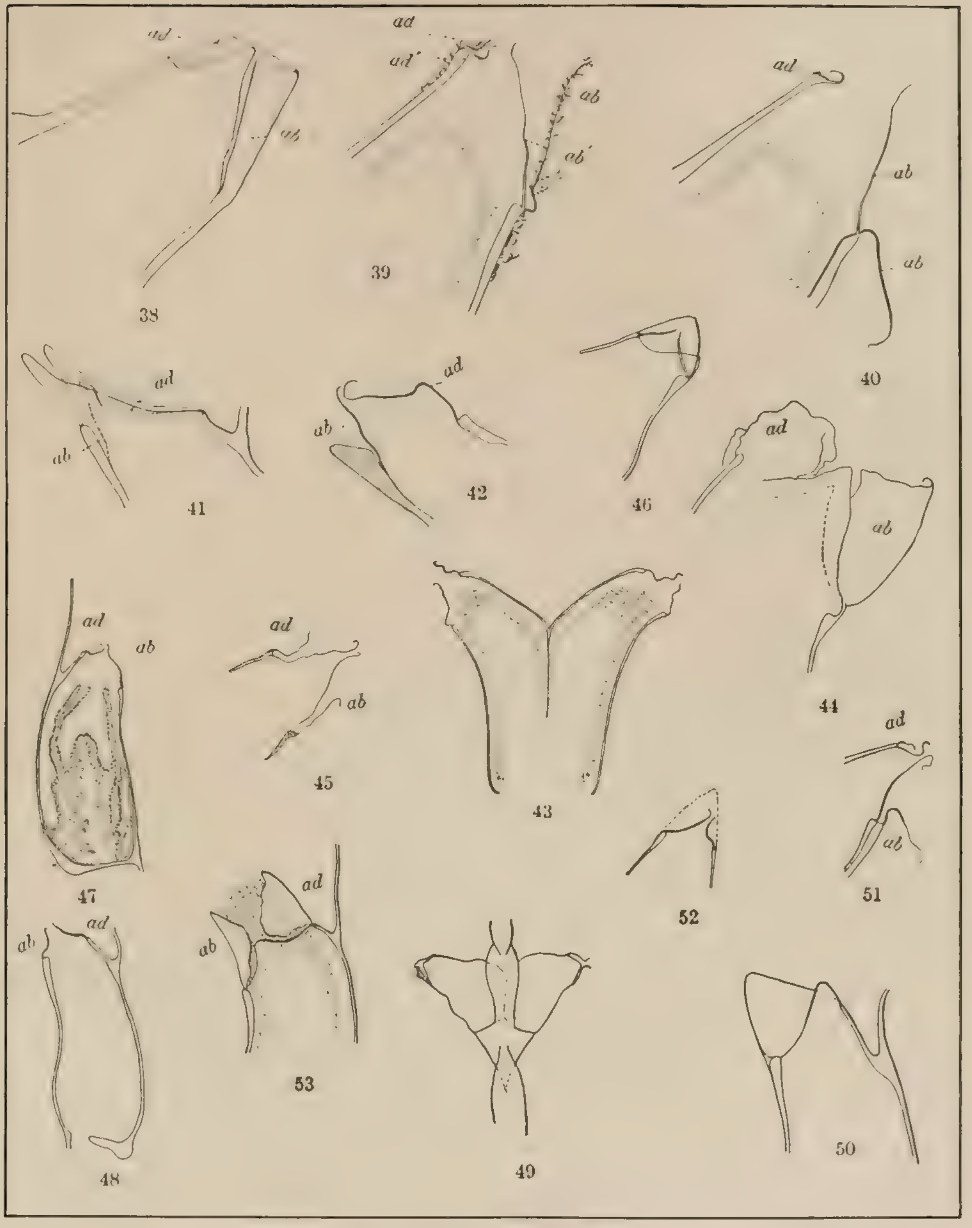
> Our attention has before been called to the fact that an operculum is found in all Sertularidæ, and that it, together with the form of the margin of the hydrotheca, is the only character by means of which we can draw a natural boundary line between the Campanularidæ and Sertularidæ. * * * There is at least a certain relation between the form of the margin and the structure and position of the operculum. Thus a *Sertularella* that has lost its operculum may be easily recognized by the three or four equally developed curves in the margin on which the operculum has been attached; and in the genera in which the operculum is a single flap the attachment of the lost operculum on the inner or outer margin will be indicated by a more or less deepened curve. * * * We may define the genus *Sertularia* thus: Aperture of the hydrotheca provided on the outer (abcauline) side with a deep emargination in which the flap-formed operculum is attached; on the opposite (adcauline) side is found a thin portion ("kraven"= collar) of similar form to the emargination mentioned above. It thus appears that on each side of the margin is a dentate or triangular projection, and that between these on the inner side is stretched a thin membrane. This membranous part is, in general, overlooked by authors who describe or delineate the margin as bilabiate or two-toothed. In a number of species this thinned portion of the wall (of the hydrotheca), which we will call the "collar," has been seen by Allman and Marktanner-Turneretscher, who, however, have both misinterpreted it, regarding it as a flap of the operculum, which, in combination with the real operculum, serves to close the aperture in the same manner as the flap of an operculum in *Sertularella*. * * * Not only the species which Marktanner-Turneretscher assigns to the genus *Dynamena*, but also the remaining species of the genus *Sertularia*, as we have defined it, have such a collar, which, by this author, is incorrectly interpreted as a flap of an operculum.

The above rather voluminous quotation from Levinsen has been given, because, in justice to that writer, it is necessary that his position should be made as plain as possible in view of the fact that the present writer is compelled to differ from Professor Levinsen and agree with Allman and Marktanner-Turneretscher in his interpretation of the operculum of the type found in *Sertularia*, that is, the so-called "two-valved" operculum (see figs. 38–53).

The origin of this type in its developmental history should be understood in order to appreciate the points in discussion that will be presented later. If we examine a very young hydrotheca of *Sertularia pumila*, for instance, we will find that its distal end is entirely covered with a very thin homogeneous membrane, continuous over the entire surface. This is deposited, like the hydrothecal walls with which it is continuous, by the ectoderm of the inclosed young hydranth. There is nothing at this stage to show any distinction whatever between the hydrothecal walls and the operculum, the margin not yet having been differentiated. In preserved specimens, however, the homogeneous membrane covering the hydrotheca is apt to be wrinkled, and these wrinkles may sometimes have the optical effect of structural characters. A little later, but before the tentacles have become plainly differentiated, the hydrothecal margin appears by a strengthening of the chitin, and can be traced as a fine, dark, sinuous line which marks the outline of the two opposite teeth, which rapidly become more and more prominent. We have now a distinct differentiation between the hydrothecal walls and that which is destined to become the operculum, although there is yet no break whatever in the continuity between these two structures, nor any opening at the distal end of the hydrotheca. The future operculum is shaped like the side walls of an "A" tent, the front and rear of the tent being closed by the two opposite hydrothecal teeth. The two flaps of the tent are of unequal size, however, the abcauline being considerably the larger. These two are nevertheless strictly homological structures, each having originated in the chitinous pellicle that covers the distal end of the budding hydranth, and each being adherent to the sides of the teeth and the portion of the hydrothecal margin between them, the two uniting along the line that would be represented by the ridge pole of the tent.

[1] Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, pp. 249–251.

[2] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1895, pp. 183–200.



ENDS OF HYDROTHECÆ, GREATLY MAGNIFIED, TO SHOW BIVALVE OPERCULA.
(*ad*, adcauline flap; *ab*, abcauline flap.)

Fig. 38.—*Sertularia pumila*, showing relation of hydrothecal teeth and opercula.

Fig. 39.—Longitudinal section of same, showing renewal of opercula. *ab* and *ad*, original opercular flaps; *ab'* and *ad'*, opercular flaps just renewed.

Fig. 40.—Longitudinal section of same, showing renewal of abcauline flap.

Fig. 41.—*Sertularia operculata*, showing marginal teeth and operculum.

Fig. 42.—Longitudinal section of same, showing operculum.

Fig. 43.—*Sertularia cornicina*, longitudinal section through a pair of hydrothecæ, showing opercula.

Fig. 44.—Same species, more highly magnified.

Fig. 45.—Same species, showing reduplication of operculum.

Fig. 46.—*Thuiaria cupressina*, showing relation of marginal teeth and operculum

Fig. 47.—Same species, showing hydrotheca and retracted hydranth.

Fig. 48.—Same species, showing empty hydrotheca.

Fig. 49.—*Sertularia brevicyathus*, showing a pair of hydrothecæ and opercula.

Fig. 50.—*Thuiaria robusta*, showing marginal teeth.

Fig. 51.—Same species, showing reduplication of margin and operculum.

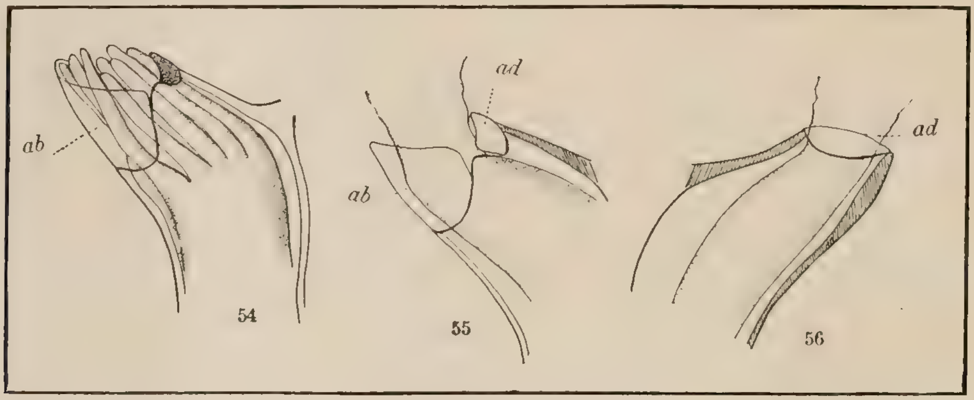
Fig. 52.—*Thuiaria tubuliformis*, showing operculum. The dotted line indicated the position of one of the marginal teetn.

Fig. 53.—Same species, showing entire operculum.

There is no important change in the operculum or margin between the stage just described and the completion of the hydranth. When the latter emerges into the outer world for the first time it seems probable that it ruptures by purely mechanical pressure the line between the points of the hydrothecal teeth, or, to use our former simile, the line along the ridge pole of the tent, the pushing tentacles being directed to that line by the sloping inner surfaces of the opercular flaps, and hence the cleavage along the line joining the summits of the teeth. After this rupture has been effected further cleavage takes place along the line of junction between the slopes of the hydrothecal teeth and the operculum, beginning at the top of the teeth (fig. 54). This may include either or both sides of the "tent," and will continue until there is room for the egress of the hydranth, leaving the bottom of both flaps still attached to the hydrothecal margin.

It is probable that Professor Levinsen would confirm the above account, with the exception of the last sentence. He holds that only the abcauline flap is opened, the adcauline remaining as the "collar" described above. This difference, however, is of great importance, as it is his justification for regarding such an operculum as composed of a single flap, while the present writer maintains that it consists of two flaps.

It will be conceded, I think, that the two flaps are identical in their origin and that they are therefore strictly homologous and similar structures. Levinsen claims that they differ in function,



RELATION OF THE OPERCULUM TO THE EXPANDING AND EXPANDED HYDRANTH OF SERTULARIA PUMILA.

Fig. 54.—Tentacles pushing aside the opercular flaps. *ab*, abcauline flap.
Fig. 55.—Base of expanded hydranth holding aside the opercular flaps. *ab*, abcauline flap; *ad*, adcauline flap.
Fig. 56.—View of the opposite side, showing adcauline flap. *ad*, adcauline flap.

the abcauline flap being a movable lid and the adcauline a fixed "collar." Mr. Paarmann's investigation seems to prove that this is a mistake, and that "sometimes the adcauline piece is attached while the other is free, and sometimes the reverse is true. Often the sides of a flap are attached for a greater or less distance proximally while they become free distally, the degree of attachment varying greatly in the same species. In most cases both flaps are functional."[1]

In fig. 9, taken from a specimen preserved with the hydranth fully expanded, it can be plainly seen that the abcauline flap is not functional, and most careful scrutiny of the original under the microscope does not reveal that it has opened at all. The hydranth is well expanded, however, and so in this case the adcauline flap must be the functional one, unless, indeed, it is so very flexible and elastic that it allows of the passage of the hydranth without the lid being elevated at all. In fig. 55 we have a case in which both flaps are plainly functional, and both are separated from the hydrothecal margin well down toward the bottom of the tooth. It thus appears that Mr. Paarmann was correct in his statement that both the abcauline and adcauline flaps are functional, although neither is constantly so, and therefore the operculum of *S. pumila* and many of its allies are properly called "two-flapped."[2] The two flaps are the same in origin, are entirely

[1] J. H. Paarmann, manuscript.

[2] The present writer has carefully verified the accuracy of Mr. Paarmann's drawings by direct comparison with the material from which they were taken.

homologous, and are usually similar in function. I shall therefore speak of the opercula of such species as *S. pumila* as two-flapped, and will include practically all of the species in which the "collar" described by Levinsen appears.[1] I have not been able to find specimens in which the collar presents just the appearance delineated by Levinsen.[2] This may be explained by the fact that my specimens were in a very good state of preservation and stained, while the hydrothecæ figured by him do not appear to contain hydranths, and may have been boiled in caustic potash or otherwise treated to bring out the unimpeded view of the chitinous parts, thus destroying the hydranths and possibly altering the appearance of the operculum. In unstained specimens it is very difficult, if not impossible, to see the fine line marking the outline of the upper border of the adcauline flap seen in fig. 56 *ad*. When this is not seen the structure looks very much as it does in Levinsen's figures.

In species with very long teeth it appears that the teeth continue growing after the operculum has been formed. If we examine a specimen of *Sertularia operculata*, for instance, we will find that the teeth project far beyond the distal ends of the opercular flaps (see fig. 41). If the operculum originated in this species in the same manner as it does in *S. pumila*, the greater part of the growth of the teeth must take place after the operculum has been formed. Otherwise the latter would reach clear to the points of the teeth. It would be interesting to study the operculum in sertularians with numerous teeth, such as are found in Australian species of *Sertularia*, and to investigate the relations between the two structures. I do not know that any one has investigated these species with this point in view.

The one-flapped operculum (figs. 66–69) is common in *Thuiaria*, and is universally found in *Abietinaria*, *Diphasia*, and *Selaginopsis*. As maintained by Levinsen, the number of teeth seems to determine the number of valves. This may be understood on purely mechanical principles. In the one-flapped forms the cleavage seems most easily effected where the operculum joins the thinner parts of the hydrothecal margin. It so happens that large groups of species seem to be fairly constant in this matter, some having the hydrothecal margin thickened on the adcauline side, as *Diphasia* and *Abietinaria*, and hence the opercular flap remains attached to that side. In other cases, as *Thuiaria* (in part), and *Selaginopsis*, the thickening is on the abcauline side and the operculum is abcauline in position. There is one very curious exception to the undoubted systematic value of this character, and that is in the case of *Thuiaria thuiarioides*, in which the species is a typical thuiarian in both trophosome and gonosome save in the one matter of the operculum, which is unmistakably adcauline in position.

The strongest and most easily seen opercula of this type are found in the genius *Diphasia*, notably in *D. digitalis* (Plate XXX, fig. 5), where this structure takes the form of a vaulted, almost dome-shaped hood, which seems to be of texture as strong and dense as that of the hydrothecal walls, and fits like a cap over the hydrothecal aperture.

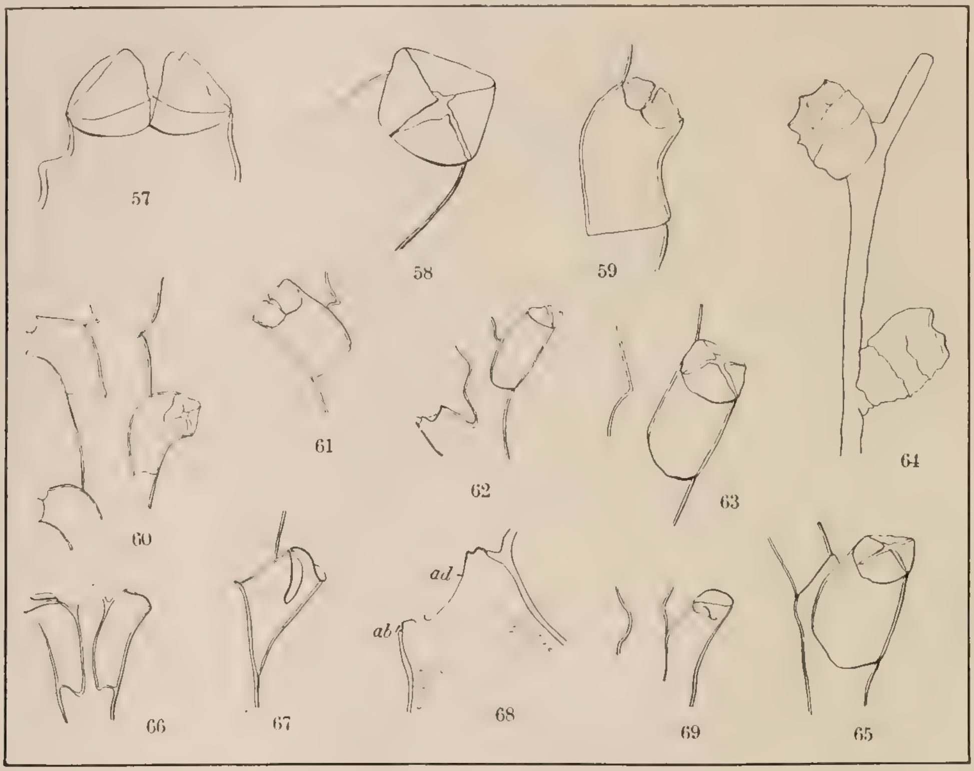
The three and four flapped opercula are characteristic of the genus *Sertularella* and *Dictyocladium*, a closely related genus. Hartlaub, as before stated, claims that this kind of an operculum differs essentially from the two-flapped form. I fail to find any very material difference, the main distinction being that in *Sertularella* the margin of the hydrotheca is usually thicker and better outlined, and the opercular structure stronger and more evident. The cause of the initial rupture of the operculum may be somewhat different in this case, although purely mechanical. The margin is stronger and more thickened at the points occupied by the teeth. These latter, moreover, are often, if not generally, slightly inclined outward or away from the center of the aperture. The former consideration would render the hydrothecal margin stiffer at the points occupied by the teeth, and the latter would result in greater tension across the operculum along lines connecting opposite teeth. When the hydranth pushes outward for the first time the elastic

[1] In order to be very sure that my interpretation of this structure is correct I have examined a number of stained and mounted specimens with great care, using high powers of magnification and examining specimens in which the hydranth was in various stages of contraction and expansion. In figs. 55–56 a specimen is illustrated which was turned over so that both the front and back views of the margin were obtained. The sketches were made by myself with the use of the camera lucida. I also examined a number of other species in which the "collar" is found.

[2] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1895, pl. VII, figs. 8–10.

operculum would be apt to yield first at the center, as the tentacles would there exert the most force, and then it would tend to split along lines radiating from the center toward the teeth. Thus there would be formed an operculum of triangular flaps, corresponding in number to the teeth of the hydrotheca (figs. 57–65).

This explanation seems to be reenforced by the condition of affairs found in the few forms of *Sertularella* that have a perfectly plain margin without teeth. In *S. formosa*, for instance, where the operculum is stretched like a drumhead across the aperture, and the margin is perfectly even, the operculum may be ruptured in almost any way, sometimes around the edge and sometimes



OPERCULA OF FOUR, THREE, AND ONE FLAP.

Fig. 57.—*Sertularella rugosa*, showing four-valved operculum.
Fig. 58.—*Sertularella gayi*, showing four-valved operculum.
Fig. 59.—*Sertularella albida*, showing four-valved operculum.
Fig. 60.—*Dictyocladium flabellum*, showing four-valved operculum.
Fig. 61.—*Sertularella tricuspidata*, showing operculum of three valves.
Fig. 62.—*Sertularella turgida*, showing operculum of three valves.
Fig. 63.—*Sertularella complexa*, showing operculum of four valves.
Fig. 64.—*Sertularella arcyi*, showing operculum of four flaps.
Fig. 65.—*Sertularella polyzonias*, showing operculum of four flaps.
Fig. 66.—*Diphasia fallax*, showing operculum of one valve.
Fig. 67.—*Hydrallmania falcata*, showing operculum of one valve.
Fig. 68.—*Hydrallmania falcata*, end of hydrotheca highly magnified to show a rudimentary abcauline flap. *ab*, abcauline flap; *ad*, adcauline flap.
Fig. 69.—*Diphasia rosacea*, showing one-valved operculum.

in jagged and irregular tears across its surface. In this case there are no points around the margin to cause greater tension along definite lines, and hence there is no regularity whatever in the formation of the opercular flaps (fig. 37).

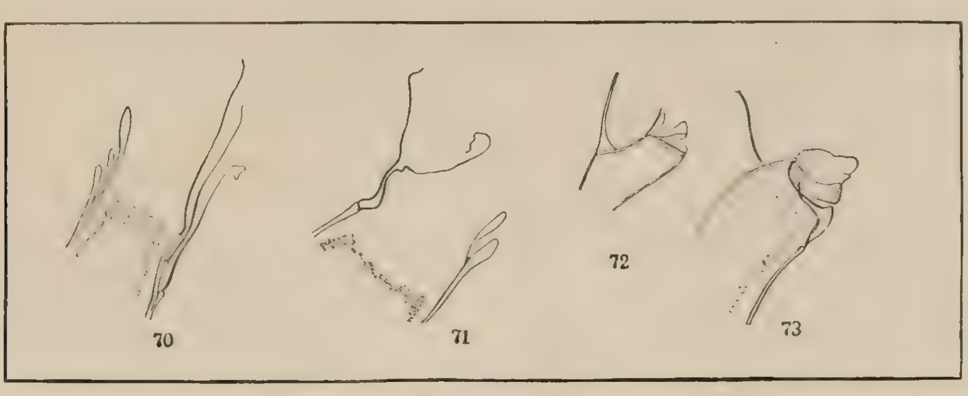
In all the cases that I have seen where there is a distinct reduplication of the margin, the operculum has also been reduplicated, the reduplications of the latter being equal to those of the margin. When we consider the genesis of the operculum and its relation to the margin, it is hard to conceive of any explanation other than that there is a direct relation between the process of regeneration of the hydranth and the reduplication of the margin and operculum.

A careful study of the matter of reduplication here referred to and the renewal of the hydranth has been made by Professor Levinsen, and the results embodied in a short but important paper, Om Fornyelsen af Ernæringsindividerne hos Hydroiderne.[1] The paper is written in Norwegian, but a condensed summary of the conclusions arrived at is found in Latin at the end of the paper. The following presents Professor Levinsen's conclusions so far as the Sertularidæ are concerned:

In *Sertulariidis* et in multis *Campanulariidis* et *Campanularinis* gemma nova extra hydrothecam antecedentem procrescit et secretio chitinea extra marginem hujus hydrothecæ extensa novam marginem vel aperturam (et in speciebus operculiferis etiam operculum novum) format.

Opercula of almost every type found among the sertularians seem to be reduplicated, as is illustrated in figs. 70–73.

Certain species of *Sertularia*, *Thuiaria*, and *Synthecium* are characterized by the fact that the distal portion of the hydrothecæ is produced into a very thin collapsible tube, which is usually of very indefinite shape in preserved specimens. It is seldom that they are of sufficient consistency to preserve their shape after the hydranth has retracted, and they are for this reason very unsatisfactory structures to study. In *Sertularia mayeri*, for instance, there is such a tube



REDUPLICATION OF MARGIN AND OPERCULUM.

Fig. 70.—*Diphasia rosacea;* longitudinal section of end of hydrotheca, highly magnified, showing the twice reduplicated margin and operculum.

Fig. 71.—Same, showing single reduplication.

Fig. 72.—Same species, much less magnified, showing reduplication of operculum.

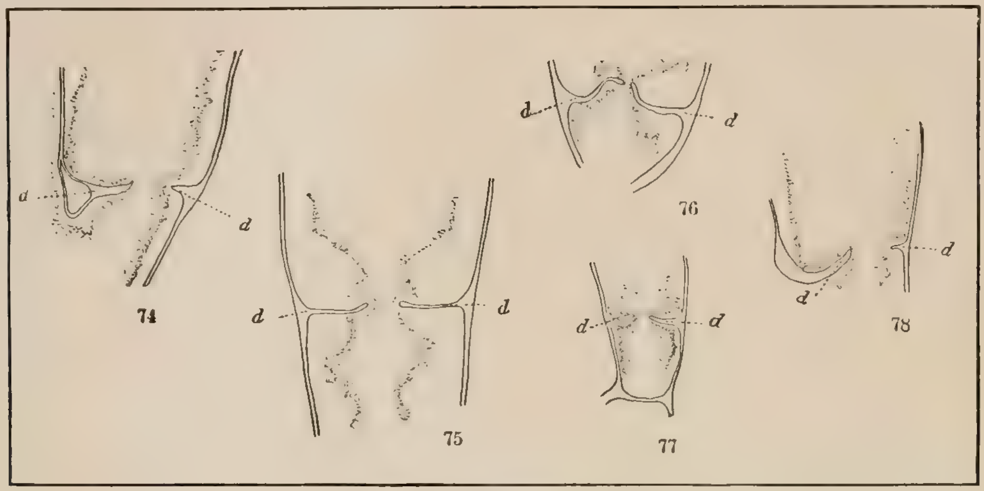
Fig. 73.—*Thuiaria tubuliformis*, highly magnified, showing reduplication of operculum.

in many cases, and it seems to extend beyond the operculum (Plate V, fig. 4). Although the origin of this tube is not definitely known, it seems reasonable to suppose that it is formed, as are all the chitinous parts of the hydrothecæ, by the excretion from the ectodermal cells of the body wall of the hydranth, and differing from the true hydrothecal walls in being very delicate and collapsible. I have not been able to assure myself of the presence of an operculum at its distal end. It may be merely an exaggerated form of reduplicated margin, having the same genesis, but not being completed to the extent of the formation of a new operculum.

The Diaphragm.—This has been already mentioned incidentally. It occurs in all of the Sertularidæ that I have examined, and does not vary greatly in form, being merely a horizontal circular shelf running around the bottom of the hydrotheca, near the point where its base joins the hydrocaulus, and dividing the hydrothecal cavity from that of the stem. There is thus left a circular opening, through which the sarcodal contents of the hydrotheca and stem form a connection. This aperture is usually eccentric in position, being nearer the abcauline than the adcauline side of the hydrothecal base (figs. 74–78). The diaphragm is regarded by Allman as one of the systematic characters by which the Sertularidæ are differentiated from other groups. It is also found, however, in other families of the Calypteroblastea, as the Campanularidæ and Campanulinidæ, although in the Sertularidæ alone it is uniformly eccentric or rather unsym-

[1] Særtryk af Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjobenhavn, 1892.

metrical, as indicated above. It has occurred to the writer that this eccentricity of the aperture of the diaphragm in the Sertularidæ may be accounted for in much the same way as the lack of radial symmetry. A nearly vertical position of the hydranth seems to be the most favorable, and where the hydrotheca is sessile the base of the hydranth is forced away from the hydrocaulus by the eccentricity of the aperture of the diaphragm, and it is thus made possible for the hydranth to assume a vertical position without the tentacles being impeded in their action by coming in too close contact with the hydrocaulus.



THE DIAPHRAGM OF THE SERTULARIDÆ.

Longitudinal sections of lower parts of hydrothecæ (highly magnified).

Fig. 74.—*Sertularia pumila;* section taken in the median plane of a pair of hydrothecæ; *d*, *d*, the diaphragm in section.
Fig. 75.—Same species; section taken in a plane at right angles to the last. Lettering as before.
Fig. 76.—*Hydrallmania falcata.* Lettering as before.
Fig. 77.—*Thuiaria robusta.* Lettering as before.
Fig. 78.—*Diphasia rosacea;* section similar to that represented in fig. 74. Lettering as before.

GONOSOME.

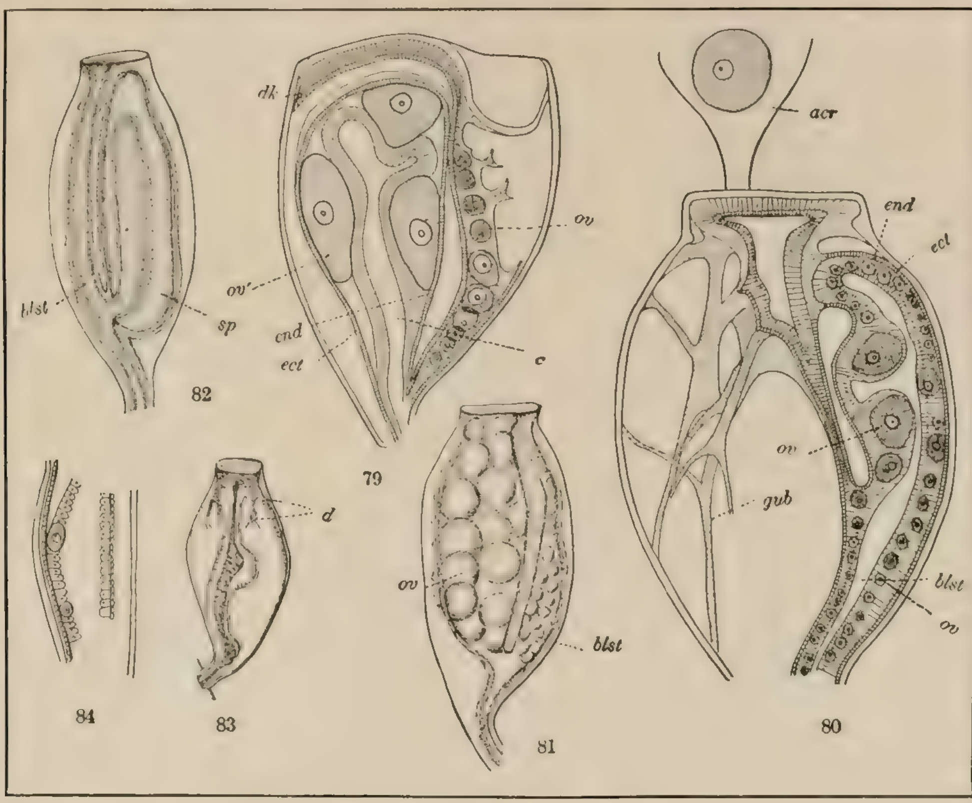
The structures which have to do with the reproduction of the species of the Sertularidæ include nothing aside from the gonangia and their contents, there being nothing to represent the corbulæ and phylactocarps so conspicuous in the Plumularidæ.[1] The absence of these has been offset in the Sertularidæ by a much greater variety of gonangia and gonophores, especially the former, which often exhibit ornamentations of surprising beauty.

Gonophores.—These structures are fundamentally the same as have been described under the Plumularidæ, but are often more conspicuous and highly specialized. Perhaps the most common form is that exhibited by *Sertularia pumila* (figs. 81–83). The blastostyle originates in the usual manner as a sort of hernia-like diverticulum from the stem or branch, containing the ectoderm and endoderm in their normal relations, and bearing a number of ova in the endoderm (see figs. 79, 84, *ov*). Weismann says that there are three cell layers external to the ova, and homologizes these layers with those of a medusa, claiming that the gonophore is merely a degraded medusa (see also Part I, p. 30). The distal end of the blastostyle is expanded into a round, more or less obconical plug ("Deckenplatte" of authors), composed of large, loosely aggregated cells principally from the ectoderm, although the endoderm is also involved in its formation. At a later stage the blastostyle is crowded to one side by a rapidly growing gonophore, which is formed as an outgrowth from the proximal end of the blastostyle, and grows to such a size that it sometimes almost fills the cavity of the gonangium from top to bottom. When fully developed (see fig. 79, *ov*), the ova are seen to have taken up their position in the ectoderm, having pierced

[1] See Part I, pp. 31–35.

the structureless stutzlamelle and greatly enlarged during the growth of the now practically mature gonophore.

The distal end of the latter at this stage is covered by a distinct layer of perisarc, which has a definite function presently to be described. It will be noted that only a few of the numerous ova in the blastostyle are included in the gonophore at this stage. A still further development results in the formation of the acrocyst, a structure found in several groups of calypteroblastic hydroids which consists in a more or less globular body composed of chitin which surmounts the gonangium and contains the ova in their later stages of development. The acrocyst is formed as follows: The chitinous distal end of the gonophore described above is pressed against the



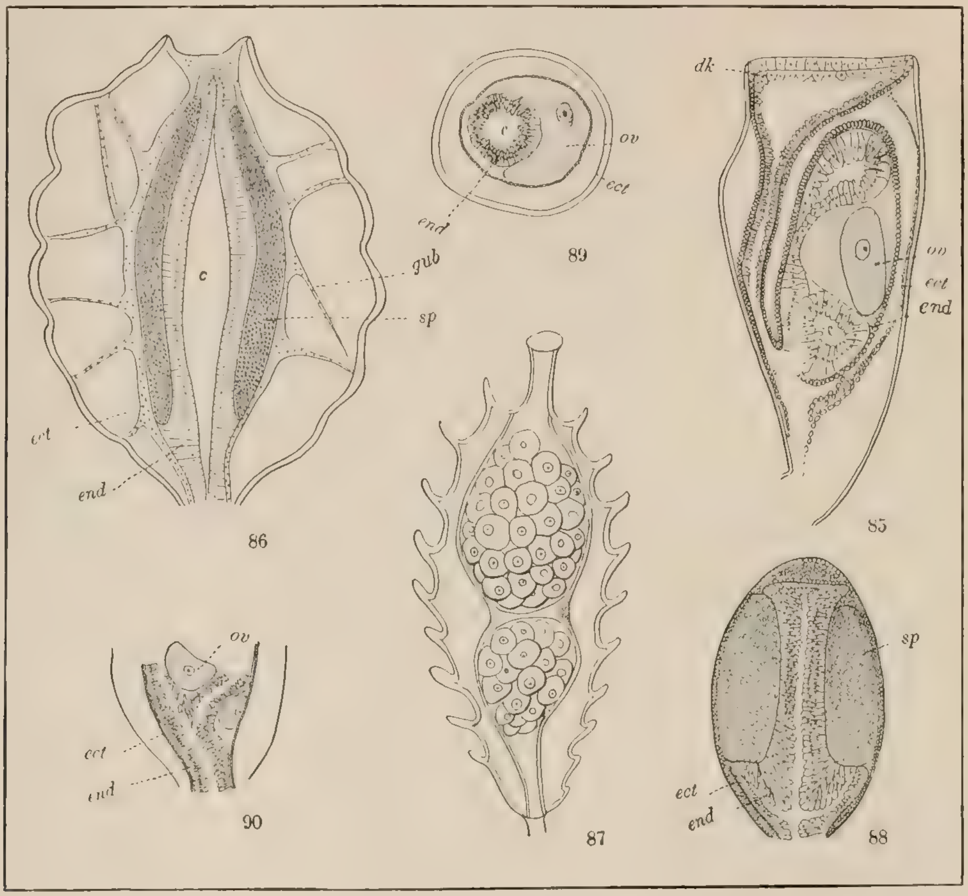
THE GONOSOME OF SERTULARIA PUMILA.
(Figs. 79 and 80, after Weismann; figs. 81, 82, and 83, after L. Agassiz.)

Fig. 79.—Longitudinal section of gonangium. *dk*, "deckenplatte"; *c*, cavity of gonophore; *ect*, ectoderm; *end*, endoderm; *ov*, ovum in endoderm of blastostyle; *ov'*, ovum in ectoderm of gonophore.
Fig. 80.—Longitudinal section of an older gonangium. *acr*, acrocyst; *blst*, cavity of blastostyle; *gub*, gubernaculum; other lettering as on fig. 79.
Fig. 81.—General view of female gonangium. *ov*, ovum; *blst*, blastostyle.
Fig. 82.—General view of male gonangium. *blst*, blastostyle; *sp*, spermary.
Fig. 83.—Gonangium, showing diverticula from deckenplatte. *d*, diverticula.
Fig. 84.—Longitudinal section of part of the stem, showing developing ova in the endoderm.

deckenplatte by the further upward growth of the gonophore. Weismann[1] says that this distal end is thrust through a hole or opening in the end of the gonangium. I have been unable to find such an opening in all cases, and would suggest that the chitinous end of the gonangium may be sometimes pierced by the chitinous end of the gonophore, much as, according to Weismann's own account, the incipient gonophore pierces the thick perisarc of the stem in *Plumularia echinulata* by what appears to be a dissolving secretion of some kind. However this may be, the end of the gonophore in some way penetrates the top of the gonangium and then expands into a globular chitinous sac into which the ova pass, and thus the acrocyst is formed (see fig. 80, *acr*). Those parts of the gonophore that are not needed in the acrocyst—indeed all parts except the developing

[1] Entstehung der Sexualzellen bei den Hydromedusen, 1883, p. 170.

ova, so far as I can discover—are then withdrawn into the gonangium, not, says Weismann, by contraction of the tissues, but by a resorption process. After the formation of the first acrocyst a number of long processes are given forth from the deckenplatte which Weismann says contain nutritive material, and may serve in the nourishment of the gonophores. The present writer has not seen these in young blastostyles, but is unable to tell whether a fully developed gonophore is the first one, or one of its many successors in a given gonangium, as the acrocyst seems to be but a transient structure, and may be replaced several times during the functional lifetime of the gonangium.



TYPICAL GONANGIA AND GONOPHORES.
(Lettering as in preceding figures.)

Fig. 85.—*Diphasia kincaidi;* longitudinal section of female gonangium, showing a single large ovum in the single gonophore.
Fig. 86.—*Sertularella complexa;* longitudinal section of male gonangium, showing the spermaries in the blastostyle, there being no proper gonophore.
Fig. 87.—Gonangium of *Sertularella filiformis*, showing large masses of ova.
Fig. 88.—*Hydrallmania falcata;* longitudinal section of male gonangium, showing spermaries, *sp.*
Fig. 89.—Same species; section across young female gonophore, showing relation of parts.
Fig. 90.—Same species; longitudinal section, including lower part of gonangium, and showing two ova.

During the formation of the first gonophore there are a large number of ova in the blastostyle above the point of origin of the gonophore (fig. 79, *ov*). When the remains of the latter have been largely resorbed after the formation of the acrocyst another gonangium is formed in the same way as the first and another lot of ova are transferred from the endoderm of the blastostyle to the ectoderm of the new gonophore, and are finally pushed through the top of the gonanium into the acrocyst.

After the retraction of the remains of the first gonophore from the acrocyst a number of irregular bands and threads are seen passing outward and downward to the gonangial walls. These are called "gubernacula" by Weismann (fig. 80, *gub*), and are supposed by him to serve

to pull aside the tissues to make room for a second gonophore. They are composed of both ectodermal and endodermal cells, and may be largely the disorganized remains of the first gonophore.

Those who are familiar with Weismann's great work will see that the above account is practically a summary of the results of his investigations. The present writer, however, has gone over the ground with some care and with good material and finds that the facts are as described by Weismann. The deductions are given on the authority of that writer, unless the context shows them to be my own.

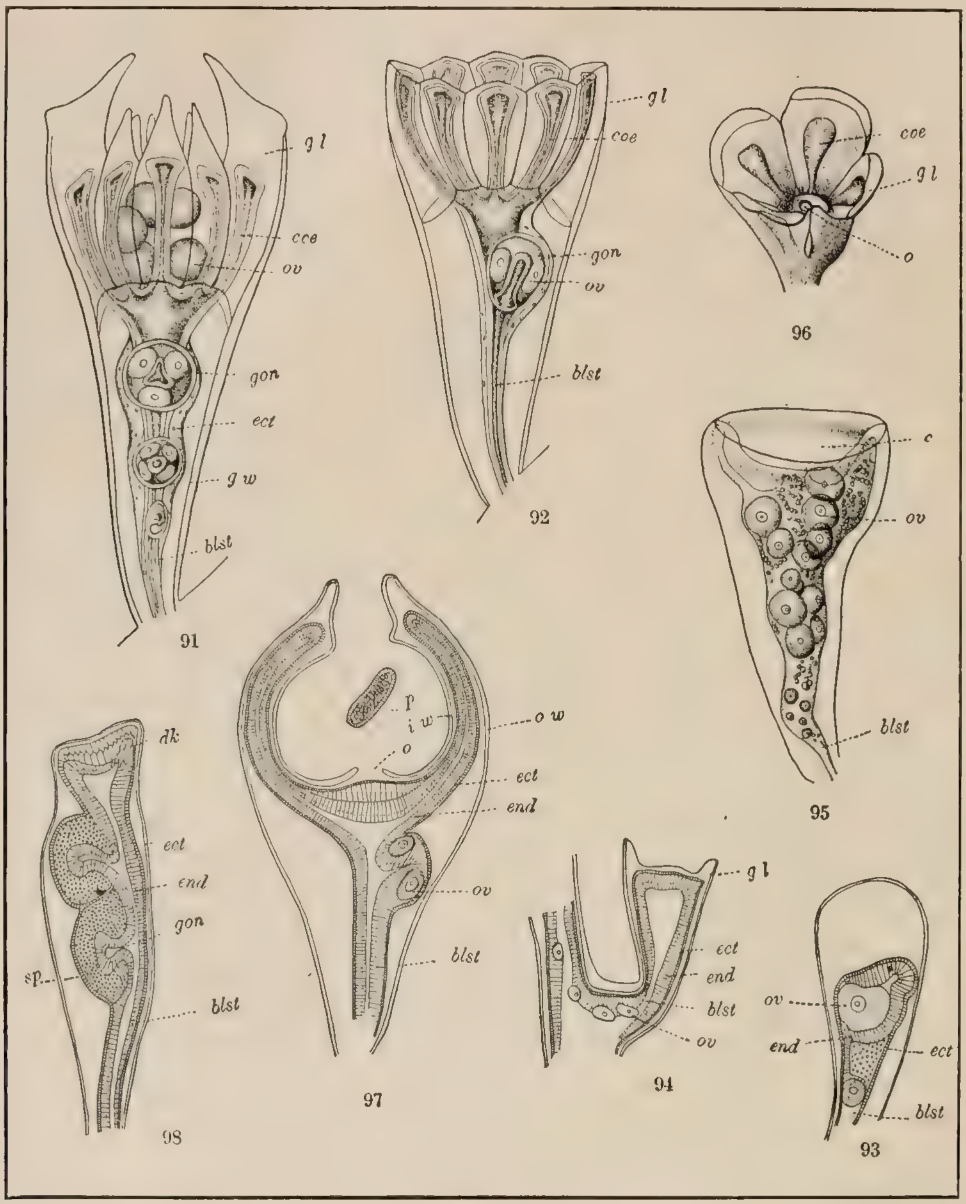
Probably the simplest form of gonophore found in this group is illustrated by *Diphasia kincaidi*, a new species described beyond. In this case the gonophore consists of a structure similar to that of *Sertularia pumila* given off from the lower part of the blastostyle. It contains, however, but a single ovum, and in optical section shows very beautifully the relationship between the ova and the various histological layers, the former being outside of the stutzlamelle and embedded in the ectoderm (fig. 85). The deckenplatte is also well shown and is seen to consist of both ectoderm and endoderm. The acrocyst does not appear to be present in this species and it is probable that the ova are discharged directly through the tops of the gonangia into the water. Practically the same type of gonophore is found in *Sertularia stookeyi*, *S. cornicina*, *Dictyocladium flabellum* and *Thuiaria robusta*, and doubtless in many other species.

Weismann examined the gonophores of *Sertularella polyzonias* and found that they differed from those of *Sertularia pumila* in the fact that no true gonophores are found, but that the sexual products are developed in the walls of the spadix of the blastostyle. I found that the same state of affairs was evident in optical section of *Sertularella complexa*. This is shown in fig. 86, where the axial blastostyle does not bear gonophores, but in which the spermaries are found embedded in the endoderm of the blastostyle itself. Numerous thread-like processes extend from the ectoderm of the blastostyle to the gonangial walls, resembling greatly the gubernacula described by Weismann. As there is here no likelihood of an acrocyst being formed, the specimen being a male gonangium, and as there is no gonophore to be accommodated, the function of these threads can not be explained as in the case of *Sertularia pumila*. They seem to be a very common feature of the various genera of Sertularidæ, and doubtless have a definite significance. In some cases there is a thin layer of ectoderm lining the gonangial walls, and these thread-like structures seem to connect this ectoderm with that of the blastostyle or gonophores in the center of the gonangial cavity. They may, of course, have a nutritive function, as suggested by Weismann in the case of the gubernacula of *Sertularia pumila*. In many species of *Sertularella* there seem to be no true gonophores, the ova being in masses around the axial blastostyle. Often they are aggregated in two or more distinct globular masses, as in *S. filiformis* (fig. 87), and some at least of these forms are provided with an acrocyst, as in *S. rugosa* (Plate XVII, fig. 2), where this structure is very conspicuous. The exact succession of events has not been worked out in such cases, but it is likely that these masses of ova are discharged into the acrocyst just as those in the gonophores of *Sertularia pumila*, the successive masses acting as do the successive gonophores.

In some species of *Sertularella*, as *S. albida*, the male gonangium contains an immense mass of sperm cells that is ovate in form. A longitudinal section of this mass shows that it is permeated by a system of diverticula from the axial blastostyle. These diverticula are apparently composed entirely of endoderm[1] covered with the stutzlamelle, and I find no ectoderm save that which forms a coating over the entire sperm mass. This seems to be a form of pseudo-gonophore derived from the condition found in *S. polyzonias* by Weismann and in *S. complexa* by myself. The diverticula spoken of are probably necessary as a means of conveying nourishment to the mass of sperm cells that is too large to be supplied by a simple unconvoluted endodermal layer, such as is found in *S. polyzonias*. If correctly interpreted, we have here a state of affairs almost

[1] This structure is probably that which is called a "Stroma-Netzes." Weismann does not state the origin of this structure, and I am by no means sure that it is correctly interpreted by me as endodermal. It appears, however, to be derived directly from the endoderm of the spadix, and seems to be composed of loosely aggregated tissue, such as we often find in the deckenplatte, where both ectoderm and endoderm are often of this histological structure.

exactly intermediate between that of *S. complexa* and the ordinary gonophore, such as is found in *Sertularia pumila*, for instance.



THE GONOSOME OF DIPHASIA.
(Figs. 91 and 92 after Allman.)

Fig. 91.—Gonangium of *Diphasia rosacea*. *coe*, lobe of cœnosarc extending upward into the gonangial leaf, *g l*; *gon*, gonophore; *g w*, gonangial wall; *ov*, ova in the "marsupial chamber." Other letters as in preceding figures.

Fig. 92.—Same species; a younger gonophore, showing earlier stage in the formation of the gonangial leaves.

Fig. 93.—*Diphasia fallax*; a very young gonangium, showing the blastostyle entering with a comparatively large ovum at its summit.

Fig. 94.—Same species; a somewhat older gonophore, showing optical longitudinal section (schematic) with ova in endoderm of stem.

Fig. 95.—Same species; a young gonangium before the development of the gonàngial leaves. *c*, convex summit of gonangium.

Fig. 96.—Same species; young gonangium in which the gonangial leaves are forming, viewed from above. *o*, small, round opening in summit of the original top of the gonangium.

Fig. 97.—Same species; a semidiagramatic longitudinal section, showing the formation of the "marsupium;" *i w*, inner wall of gonangial leaf; *o w*, outer wall of gonangial leaf; *o*, opening in the original top of the gonangium; *p*, planula.

Fig. 98.—Same species; longitudinal section of a male gonangium, showing two gonophores with spermaries.

A very simple male gonangium is found in *Hydrallmania falcata* (figs. 88, 90, 111), where the axis of the blastostyle, composed of endodermal cells, constitutes a simple spadix around which the sperm cells grow in a mass, the outside of the mass being covered with ectoderm.

The most complicated gonosome found in the Sertularidæ is that illustrated by *Diphasia rosacea* and several other species of the same genus which appear to possess an acrocyst which is itself inclosed in a marsupial chamber (figs. 91, 92). This very remarkable structure was first described with care by Professor Allman,[1] and this description still remains the best that I have seen, although it contains some inaccuracies that will shortly be pointed out. I have made a careful study of *Diphasia fallax*, both entire and in serial sections, with the following results:

A very young female gonangium (see fig. 93) is a club-shaped chitinous pellicle within which the young blastostyle grows as a direct derivative of the cœnosarc of the stem. At its very summit is a large ovum enveloped apparently in lobular diverticula from the blastostyle, another and smaller ovum being seen a short distance below. At a later stage the gonangium is obconical or trumpet-shaped (see figs. 94, 95), and the blastostyle has expanded so as to fill its distal portion with a sort of plug. At this stage the summit of the gonangium is convex, or bowl-shaped, with the aperture in the center of the bowl, just above the axis of the blastostyle. The rim of this bowl now grows rapidly, forming four broad scallops, and ultimately four broad leaves, which are really flattened tubes of chitin. From the peripheral portion of the distal end of the cœnosarcal plug (deckenplatte) four lobes composed of ectoderm and endoderm project into the flattened tubes of chitin just mentioned and doubtless furnish material for the growth of the latter[2] (see fig. 96). These lobes grow rapidly, especially in length, and finally their tips arch over until they meet. The edges of the leaves coalesce, and thus is formed a globular chamber above the original top of the gonangium, the walls of the chamber being composed of the broad leaves which originated from the edge of the bowl-like summit of the young gonangium. In the meantime the ova in the blastostyle have arranged themselves in definite groups, the largest group being the distal one, each group being now borne in a separate gonophore, the gonophores being arranged serially along one side of the blastostyle. A tendency toward such a grouping is seen in even quite a young gonophore (see fig. 95). The present writer believes, from his study of *Diphasia fallax*, that Professor Allman was mistaken in two particulars in his description of the gonosome of *Diphasia*. First, in describing the development of the gonangium (of *D. rosacea*) that writer says:[3]

> A blastostyle occupies its axis, having upon its sides, one over the other, the young budding gonophores, and expanding at its summit into a broad, thick disk, which closes, as with a plug, the free end of the gonangium. Upon the outer side of this disk a thin chitinous investment is excreted, becoming continuous at the edge of the disk with the chitinous walls of the gonangium.

This latter sentence conveys the idea that the end of the gonangium is formed subsequent to the formation of the walls. As a matter of fact, it is entirely homologous with the summit of other gonangia, and is continuous with the walls in the youngest gonangium that I have been able to find (see fig. 93, which is a highly magnified view of a very young gonangium). In its early stages the gonangium of *Diphasia fallax* is precisely similar to all other gonangia, so far as this character is concerned. Fig. 95 presents an appearance that might at first lead one to adopt Allman's view, as in this case the concave summit of the gonangium rests immediately on the deckenplatte. But when one studies a series of young gonangia it becomes evident that we have here merely the elevation of the peripheral portion of the gonangium top preparatory to the growth of the leaves destined to form the marsupium. Secondly, Professor Allman, after describing the acrocysts of several species, adds:

> In the cases above described the acrocyst is destitute of any further covering, and has its walls with their gelatinous investment, freely exposed to the surrounding water. In *Sertularia rosacea*, *S. fallax*, and *S. tamarisca*, however, an additional covering is provided for the acrocyst, and there is thus formed a curious and complicated receptacle, in which the ova, as in a sort of marsupium, pass through certain early stages of their development, previously to being discharged into the surrounding water (p. 50).

[1] A monograph of the Gymnoblastic or Tubularian Hydroids, London, 1871, pp. 50–54.

[2] These lobes Allman very plausibly interprets as being the homologues of the lobular or sack-like processes which extend downward from the deckenplatte in *Sertularia pumila*. The derivation of the two structures is evidently identical, and the only difference between them seems to be in the direction of their growth, which is upward in *Diphasia fallax* and downward in *Sertularia pumila*.

[3] Gymnoblastic Hydroids, pp. 50–51.

A study of serial longitudinal sections of *Diphasia fallax*[1] shows that no true acrocyst is found in this species. It is true that an examination of entire adult gonangia with transmitted light seems to reveal an inner globular chamber besides the outer one formed by the gonangial leaves. That this is an optical illusion is seen when a median longitudinal section is studied (see fig. 97).

The inner and outer walls of a gonangial leaf are seen to be widely separated and not strictly parallel, the distal end being much thicker than the rest. The result is that the inner profile of the leaf forms nearly a half circle and, in conjunction with its fellow on the opposite side, forms nearly a complete circle which looks almost exactly like the outline of a sphere when seen from the side. Thus it happens that we have the appearance of a sphere in the center of the marsupial chamber, occupying, indeed, the exact position of an acrocyst. As there are eight of these leaves in *D. rosacea* their inner edges would thus simulate the outline of a sphere when viewed from any side.

It might be argued that the acrocyst, according to my own statement, is but a temporary structure, and might therefore have been absent in the specimens studied by me, but present in those studied by Professor Allman. In some of my specimens there were ova or planulæ in the marsupial chamber (fig. 97, *p*). Under these conditions, if ever, the acrocyst would be present.

The male colonies of *Diphasia* produce gonangia without the marsupium, and hence of very different appearance, and it was this fact, doubtless, that led the elder Agassiz to give the name "*Diphasia*" to this genus. Fig. 98 represents a longitudinal median section of a male gonangium of *Diphasia paarmanni* containing a blastostyle which bears gonophores in a series, each consisting of a simple spadix surrounded by a mass of sperm cells. The gonangia are unusually long and slender, and often contain a row of five or six gonophores.

We have now considered all of the distinct types of gonophores found in the Sertularidæ, so far as known to the writer.

THE GONANGIUM.

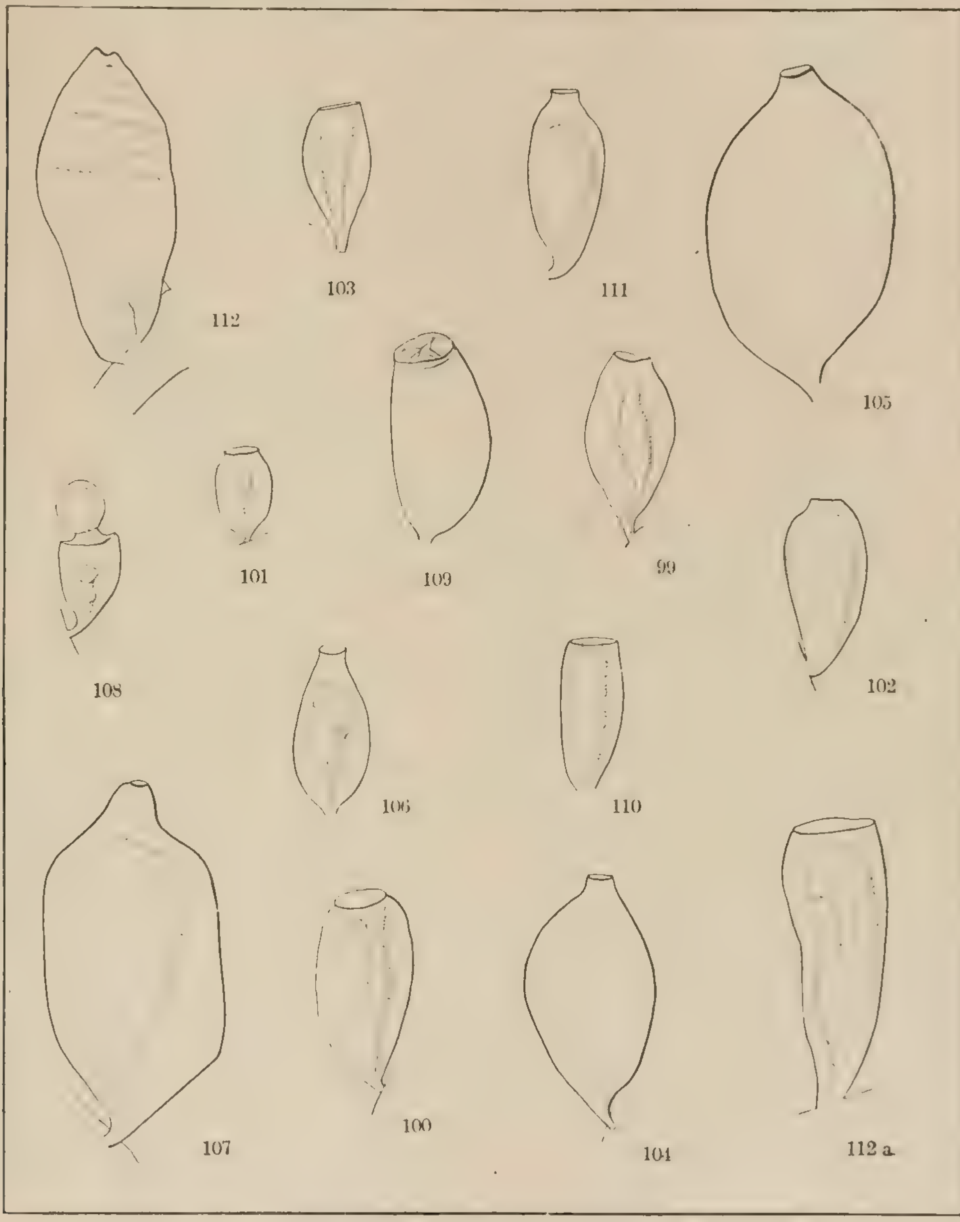
This structure is much more diversified in the Sertularidæ than in the Plumularidæ, due probably to the fact already suggested that the gonangia in the latter family are often protected by various forms of phylactocarps, and hence are not so much influenced by the immediate environment of the species.

Perhaps the most typical form of gonangium is the simple oblong oval, truncated at the top, well illustrated by *Sertularia pumila* (fig. 99), *S. operculata* (fig. 100), *S. stookeyi* (fig. 101), *Thuiaria thuja* (fig. 102), *Diphasia kincaidi* (fig. 112*a*), and *Abietinaria gigantea* (fig. 103). The main modification of this form consists of the narrowing of the distal end of the gonangium so as to form a short tubular neck, as in *A. costata* (fig. 104), *Thuiaria turgida* (fig. 105), and *Thuiaria tubuliformis* (fig. 106). This narrowing may be such as to form a short cone instead of a tube, as in *Dictyocladium flabellum* (fig. 107); or it may form a frustum of a cone, as in *Abietinaria greenei* (fig. 108). Where the aperture is large an operculum is usually present, as in *Sertularia stookeyi* (Plate V, fig. 6), and *Sertularella formosa* (fig. 109).

The most common form of ornamentation found in the gonangia of this group is brought about by annular rugosities which are often exceedingly graceful and beautiful. One of the most attractive structures in the whole family is the gonangium of *Sertularella tricuspidata* (Plate XXV, figs. 4 and 5). Similar gonangia are found in *S. filiformis* (fig. 113), and the most excessive ornamentation along this line is seen in *Sertularella elegans* (fig. 114), where the annulations take the form of greatly compressed ridges which are elaborately frilled so as to resemble lace work (Plate XXIV, fig. 1). Sometimes these annulations are confined to the distal or upper part of the gonangium, and are much broader and less incised, as in *S. allmani* (fig. 115), *S. catena* (fig. 112), *S. meridionalis* (fig. 116), and *S. albida* (fig. 122).

[1] These sections, as well as the others used in the study of the gonosome of the Sertularidæ, were made for me by Mr. William B. Bell, one of my students.

In most cases the annulations are approximately parallel, but sometimes, as in *Sertularella pinnata*, they are exceedingly irregular, giving an appearance of great distortion (fig. 117, and Plate XXI, fig. 10). Every intergradation in the depth of these rugosities is found, ranging

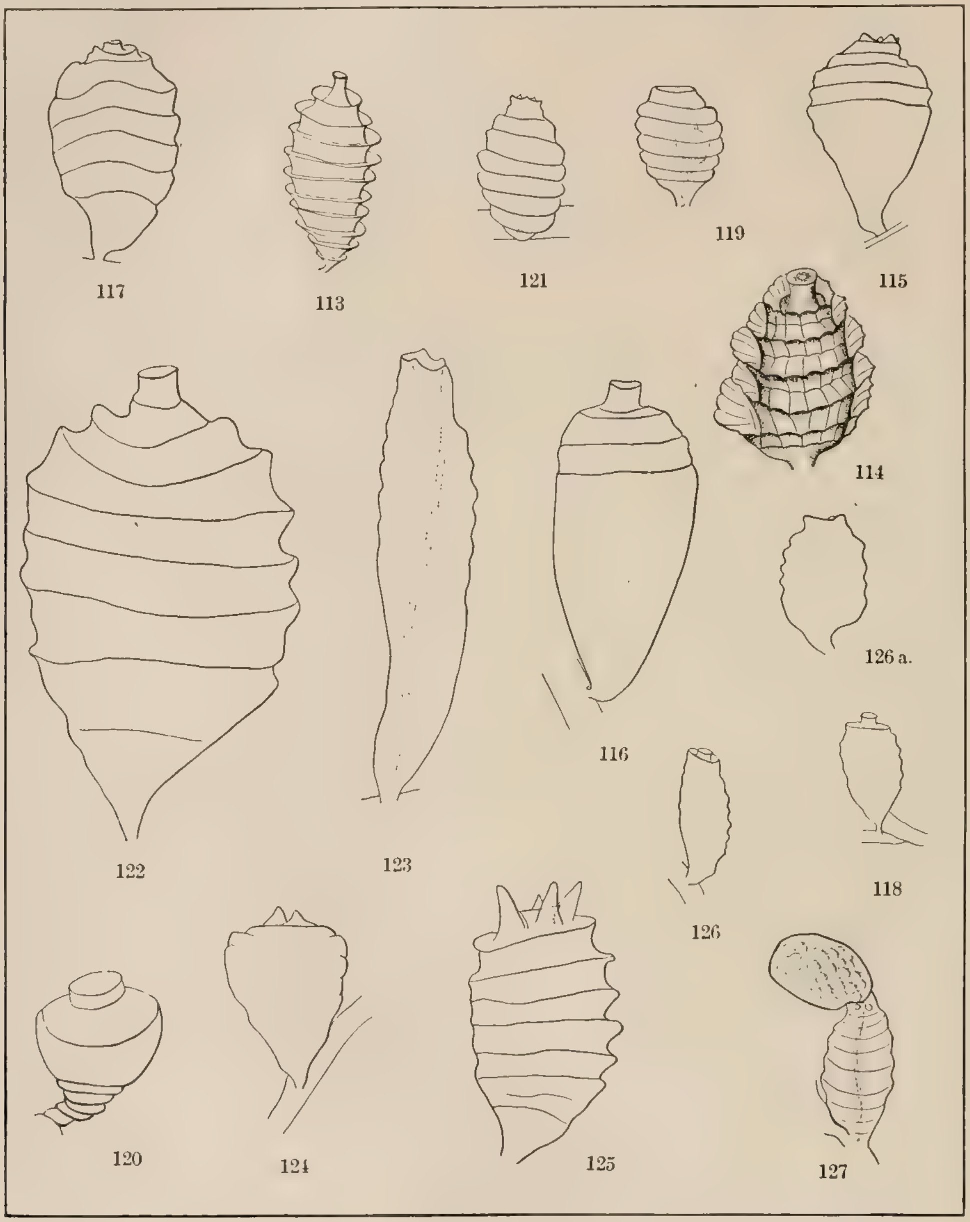


TYPICAL GONANGIA OF THE SERTULARIDÆ.
(All figures drawn to the same scale.)

Fig. 99.—*Sertularia pumila.*
Fig. 100.—*Sertularia operculata.*
Fig. 101.—*Sertularia stookeyi.*
Fig. 102.—*Thuiaria thuja.*
Fig. 103.—*Abietinaria gigantea.*
Fig. 104.—*Abietinaria costata.*
Fig. 105.—*Abietinaria turgida.*
Fig. 106.—*Thuiaria tubuliformis.*
Fig. 107.—*Dictyocladium flabellum.*
Fig. 108.—*Abietinaria greenei*, with acrocyst.
Fig. 109.—*Sertularella formosa*, showing operculum.
Fig. 110.—*Diphasia fallax* (young).
Fig. 111.—*Hydrallmania falcata.*
Fig. 112.—*Sertularella catena.*
Fig. 112a.—*Diphasia kincaidi.*

between the excessively deep ridges of *Sertularella elegans* and the hardly visible ones of *S. levinseni* (fig. 118). While these annulations are especially characteristic of the genus *Sertularella* they are also found in *Sertularia*, as in *S. cornicina* (fig. 119), in *Abietinaria coei* (fig. 120), and in a few other species outside of the genus *Sertularella*.

A phenomenon so constant and so widespread as this kind of gonangial ornamentation is generally supposed to have some utility to the animals possessing it, and it is not difficult to find a use for these corrugations on purely mechanical grounds. Gonangia are structures that are

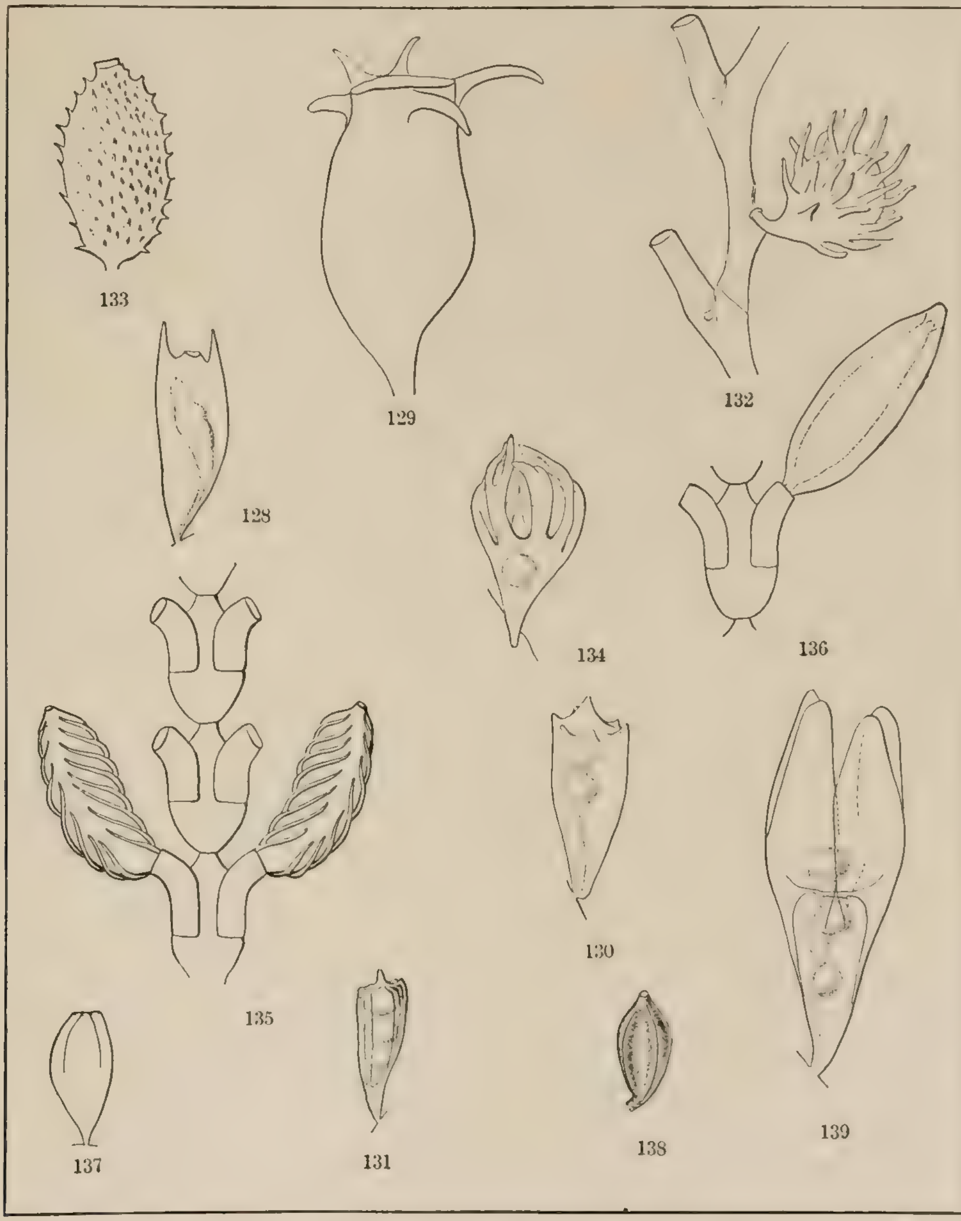


ANNULATED GONANGIA OF THE SERTULARIDÆ.
(All figures drawn to the same scale.)

Fig. 113.—*Sertularella filiformis.*
Fig. 114.—*Sertularella elegans.*
Fig. 115.—*Sertularella allmani.*
Fig. 116.—*Sertularella meridionalis.*
Fig. 117.—*Sertularella pinnata.*
Fig. 118.—*Sertularella levinseni.*
Fig. 119.—*Sertularia cornicina.*
Fig. 120.—*Abietinaria coci.*
Fig. 121.—*Sertularella complexa.*
Fig. 122.—*Sertularella albida.*
Fig. 123.—*Sertularella gayi* var. *robusta* (an exceptionally slender specimen).
Fig. 124.—*Sertularella contorta.*
Fig. 125.—*Sertularella polyzonias.*
Fig. 126.—*Sertularella subdichotoma.*
Fig. 126*a*.—*Sertularella subdichotoma* (without tubular neck).
Fig. 127.—*Sertularella rugosa.*

primarily for the protection of the sexual persons of the hydroid colonies, and the stronger their walls the more efficient is the protection afforded. Man has long ago found that by corrugating sheets of iron or tin their strength to resist lateral pressure is greatly increased. Doubtless the same thing is true of gonangial walls made of chitin, and this may indicate a possible utility for

this feature, one that is ordinarily spoken of as being merely ornamental in structure. But what shall we say when contemplating such apparently riotous and frivolous excesses as are indulged in by *Sertularella elegans*, for instance? It seems as if here Nature had gone to altogéther unnecessary lengths, even if she did start by forming the rugosities on purely



SPINED AND RIBBED GONANGIA OF THE SERTULARIDÆ.
(All figures, except 132, 135, 136, and 138, drawn to the same scale.)

Fig. 128.—*Thuiaria robusta.*
Fig. 129.—*Sertularella quadrata.*
Fig. 130.—*Diphasia paarmanni.*
Fig. 131.—*Diphasia rosacea* (female).
Fig. 132.—*Sertularia echinocarpa.* (After Allman.)
Fig. 133.—*Diphasia digitalis.*
Fig. 134.—*Selaginopsis ornata.*
Fig. 135.—*Synthecium campylocarpum* (female). (After Allman.)
Fig. 136.—*Synthecium campylocarpum* (male). (After Allman.)
Fig. 137.—*Abietinaria alexanderi.*
Fig. 138.—*Abietinaria costata.*
Fig. 139.—*Diphasia paarmanni* (male).

utilitarian lines. There are many such cases known to naturalists, in which it appears that development along certain lines had received in some way such an impetus or momentum that the resulting structure goes far beyond the utilitarian demands of the case and enters the realm of merely capricious excess.

As an outcome of this we have many structures that are exquisitely beautiful or graceful, or at times merely grotesque.

In a few cases the rugosities are longitudinal, rather than transverse or annular, and we have the ribbed gonangia, such as are seen in *Sertularella episcopus* (Plate XXVI, fig. 7), *Abietinaria gracilis* (Plate XXXV, fig. 1), and *Abietinaria costata* (fig. 104). In a number of species the superficial ornamentation takes the form of horn-like processes or long spines, which may be two in number and borne on the shoulders of the gonangium, as in *Thuiaria argentea* (Plate XII, fig. 9) or *T. robusta* (Plate VII, fig. 7), or there may be four or more radiating from the gonangial aperture, as in *Sertularella quadrata* (fig. 129). In the male gonangia of several species of *Diphasia* there are a number of conical spines arranged in a circle around the distal end, as in *D. paarmanni* (fig. 130), or the whole of the distal end of the gonangium may be bristling with spines, as in *Sertularella turgida* (Plate XXII, fig. 2). The extreme of spinulation is reached in *Sertularia echinocarpa* Allman (fig. 132) and *Diphasia digitalis* (fig. 133), where the entire surface of the gonangium is beset with spines. A very curious ornamentation is found in *Selaginopsis ornata* (fig. 134), where there arise from the distal surface eight long slender bifurcating processes which may be for the purpose of forming a sort of pseudo-marsupium as a protection for the ova in the later stages of their development.

Still another kind of gonangial ornamentation has already been discussed, that is the broad leaves, four or eight in number, that form the marsupial chamber in the female gonangium of several species of *Diphasia* (figs. 91–97).

A very graceful surface marking is seen in *Synthecium campylocarpum*, where the gonangia are furnished with two series of opposite and gracefully curving rugosities forming a bilateral ornamentation that is very rare among the Hydroida (fig. 135).

The gonangial aperture is usually either round or squarish in outline, and is always terminal in this group, never taking on the lunate form and lateral position seen in some of the Plumularidæ.[1] As would be expected, the aperture of the female gonangium is, in general, considerably larger than that of the male. Probably the largest aperture in proportion to the size of the gonangium that I have seen is that of *Sertularella megastoma* (Plate XX, fig. 9). In many cases the aperture is elevated on a sort of collar which may be a simple narrow band, as in *Sertularia gracilis* (Plate III, fig. 10), or a broad band, as in *Abietinaria coei* (fig. 120), where it is quite conspicuous on the upper surface of a top-shaped gonangium. Often this collar is produced into a tube with a flaring or trumpet-shaped distal end, as in *Sertularella filiformis* (fig. 113), and *S. meridionalis* (Plate XXIII, fig. 8). In some cases there appears to be a tube within a collar, as in *Sertularella tricuspidata* (Plate XXV, fig. 5). Rarely this collar is quadrate in form, as in *Sertularella fusiformis* (Plate XX, fig. 4). In many cases, however, the mouth is not elevated above the general surface of the top of the gonangium, where it may be surrounded by a series of from two to five blunt spine-like prominences that are often used as specific characters, as, for example, in *Sertularella polyzonias* (fig. 125), *S. contorta* (fig. 124), and *S. complexa* (Plate XXI, figs. 7 and 9). This kind of ornamentation appears to be confined to *Sertularella*.

Superficial color markings are exceedingly rare on the gonangia. The only cases that I know of among American Sertularidæ are found in *Abietinaria costata* (Plate XXXVI, fig. 12), where the summits of the longitudinal ridges are marked by distinct black lines that are very conspicuous in comparatively fresh specimens, and the same thing is much less conspicuously seen in *A. amphora* (Plate XXXIV, fig. 4).

The gonangia of several species of *Thuiaria*, as *T. thuiarioides* (Plate VIII, fig. 6), and *Abietinaria*, as in *A. variabilis* (Plate XXXII, fig. 7), are peculiar in having a number of sharp chitinous teeth arranged in a circle on the inside, just below the aperture. I am unable to understand the function of these teeth, unless they serve as a sort of anchorage for the deckenplatte, very much as similar teeth at the bottom of the hydrothecæ of certain campanularians are supposed to serve for points of attachment for the hydranth.

The text figures 99 to 139 are all drawn to the same scale, and show the variation in size that is found among the gonangia of the Sertularidæ.

[1] See Part I, pl. IX, fig. 3.

DEVELOPMENT OF THE SERTULARIDÆ.

Origin of the sex cells.—As in so many respects the two families Plumularidæ and Sertularidæ here show their close relationship. So far as I can determine there is no difference between them in this respect. In all species of Sertularidæ in which the matter has been investigated both the male and female sex cells originate in the endoderm of the stem and branches, or at least are found in this position at a very early stage. Weismann reports this to be true of *Sertularia pumila* and *Sertularella polyzonias*, and I have found the same thing in *Sertularia pumila*, *Hydrallmania falcata*, *Sertularella complexa*, *Diphasia fallax*, *Diphasia kincaidi*, and *Abietinaria turgida*. These comprise all of the species that I have examined for the purpose. The sex cells originating in the endoderm of the stem are carried into the developing gonangium along with the young blastostyle, or else migrate as do those of the Plumularidæ, the presumption being in favor of the latter, although I do not know that the process has been completely demonstrated.

The development of the gonangium has been partially described in the case of *Diphasia fallax*. It seems that the process is, in general, the same as in the Plumularidæ,[1] and the same thing seems to be true in the development of the ovum and that of the colony as a whole.

As already stated, there are no known sertularians that produce free medusæ, nor do the gonophores present any easily recognizable medusoid features.

Weismann has found, however, the characteristic cell layers that are seen in the medusoid forms, and this leads him to pronounce the sertularian gonophore a very much degraded medusa, an opinion that can not be gainsaid in the present state of our knowledge.

SYSTEMATIC DISCUSSION.

Family SERTULARIDÆ Fleming (modified).

Trophosome.—Hydranth with a conical or dome-shaped proboscis and a single verticil of filiform tentacles. Hydrothecæ sessile, adnate or more or less embedded in the hydrocaulus, arranged definitely and in more than a single row.[2] An operculum composed of from one to four parts is almost always present. Nematophores wanting.

Gonosome.—Gonophores inclosed in gonangia, and always producing ova or spermatozoa without the intervention of a medusoid form.

The family Sertularidæ,[3] containing as it does the longest known genera of calypteroblastic forms, has been defined by a number of writers, the general tendency being, as would be expected, toward a more and more strict delimitation of the group. The above definition is in substantial agreement with the views of most of the present authorities. Taken as a whole, the family is a fairly well circumscribed group, although it has points of contact with campanularian forms through the genus *Thyroscyphus* Allman,[4] which agrees with the Campanularidæ in having the hydrothecæ supported on pedicels, and with the Sertularidæ in the characters of its hydranths,

[1] See Part I, pp. 36–39.

[2] An apparent exception is found in *Hydrallmania*, where the bases of the hydrothecæ are aligned in a single row on the upper side of the branches. Here, however, the distal portions of the hydrothecæ are bent alternately to the right and left, and nematophores are never found. These characters are sufficient to separate the genus from the family Plumularidæ with which it was formerly associated. Its place in the Sertularidæ has not been questioned by any recent writer.

[3] The original spelling of this word seems to have been Sertulariadæ. The first time that it occurs is in A History of British Animals, by Fleming, Edinburgh, 1828, p. 538. Johnston, in the second edition of British Hydroid Zoophytes, London, 1847, uses the same spelling, as does Alexander Agassiz, in his Catalogue of North American Acalephæ, Cambridge, 1865. Hincks, in his classic work, British Hydroid Zoophytes, London, 1868, p. 233, adopts the spelling Sertulariidæ, in which he has been followed by a few British and American writers.

McCready, one of the pioneer American workers in this field, introduces the spelling "Sertularidæ," in 1858, in which he is followed by Louis Agassiz, in his Contribution to the Natural History of the United States, IV, 1862, p. 355, and Allman in several of his later works, and most of the present workers, both American and European.

[4] Hydroids of the Gulf Stream, Memoirs of the Museum of Comparative Zoology, V, No. 2, 1877, p. 10.

and in having a well-marked operculum consisting of four segments. On the other hand, we find in some species of *Selaginopsis* a superficial resemblance to certain of the Perisiphonidæ and Lafoeidæ, both of which families have the hydrothecæ without pedicels and arranged on all sides of the hydrocaulus, but which differ from the Sertularidæ in having the stem and usually the branches composed of a number of parallel tubes.

The genus *Hydrallmania*, as indicated above, bears some resemblance to the Plumularidæ in having its hydrothecæ arranged in a linear series on the upper sides of the branches, but differs from all known plumularians in having the distal ends of the hydrothecæ bent alternately to the right and left, as well as in the absence of nematophores.

Although the family itself seems to be sufficiently well characterized, almost insuperable difficulties are encountered when we attempt to break it up into genera. Various writers have offered solutions which seem well conceived when the material at hand is limited, but which break down more or less completely when all material available from more recent explorations is taken into consideration. Perhaps the difficulties encountered in trying to solve this exceedingly perplexing problem can best be demonstrated by a brief summary of the attempts made by the more important authorities, beginning with Hincks's epoch-making work, British Hydroid Zoophytes, published in 1868. This writer divides the Sertulariidæ into the following genera:[1]

Sertularella.—Hydrothecæ biserial, decidedly alternate, operculum composed of several pieces.

Diphasia.—Hydrothecæ opposite, occasionally subalternate, a pair to each internode, with an internal valve-like operculum. Female gonangium with an internal marsupial chamber.

Sertularia.—Hydrothecæ biserial, opposite or alternate, without external operculum. Gonangia without internal marsupium.

Thuiaria.—Hydrothecæ biserial, embedded in the substance of the stem and branches.

All of these genera, modified to accommodate themselves to the results of later investigations, are still retained by recent writers and in the present work.

In December, 1874, Professor Allman read a paper before the Linnæan Society,[2] in which he defined the following new genera:

Desmocyphus.—Hydrocaulus bearing hydrothecæ which are adnate to each other in pairs, and each pair adnate to the front of the hydrocaulus.

Synthecium.—Each internode of the hydrocaulus bearing a pair of opposite sessile hydrothecæ. Gonangia on peduncles springing from within the cavity of hydrothecæ.

Selaginopsis.—Hydrothecæ disposed in several longitudinal rows about the nonfascicled hydrocaulus.

Pericladium.—Hydrothecæ more or less immersed and closely set around bifurcating ramuli which spring from the sides of a common stem.

In this work Professor Allman separates the genus *Thuiaria* from the Sertularidæ and places it in a new family, the Thuiariidæ.

In his report on the Hydroida collected by the *Challenger*[3] the same author modifies the genus *Sertularia* so as to include the genus *Sertularella*, modifies the genus *Thuiaria* and restores it to the Sertularidæ, and forms three new genera. His classification is as follows:

Sertularia.—Hydrothecæ sessile, in two series, opposite or alternate, margins entire or dentate, sides more or less adnate to the hydrocaulus, an internode to each two hydrothecæ. Operculum present or absent.

Thuiaria.—Internodes of hydrocaulus each bearing many hydrothecæ which are alternate or opposite, more or less adnate to hydrocaulus, margin entire or dentate.

Diphasia.—Substantially as defined by Agassiz and Hincks.

Desmoscyphus, *Synthecium*, and *Thecocladium.*—As defined above.

Hypopyxis.—Like *Desmoscyphus*, but with two minute cup-shaped appendages (nematophores?) at the base of each hydrotheca.

Staurotheca.—Hydrocaulus with opposite hydrothecæ arranged in decussating pairs.

Dictyocladium.—Hydrocaulus forming a flabelliform network of anastomosing stems and branches. Hydrothecæ on all sides of branches.

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[1] British Hydroid Zoophytes, London, 1868, p. 234 *et seq.* The above table is not a quotation direct, but a condensed statement of the most important points in his definitions of genera.

[2] Linnæan Society Journal, Zoology, XII, 1876, p. 252 *et seq.*

[3] Report on the Hydroida, Part 2, 1888, pp. 49, 50.

The tendency to multiply genera reached its maximum in a work published in 1890 by Marktanner-Turneretscher[1] in which he adopts all of Allman's genera, restores *Sertularella*, and proposes two new genera. As this writer's scheme of classification is more comprehensive than any other, it is given here in somewhat condensed form and translated into English:

1\. Branches forming a reticulate network 2
2\. Hydrothecæ in more than two rows. Margins even .... DICTYOCLADIUM.
Hydrothecæ arranged otherwise 3
3\. Hydrothecæ paired, adjacent pairs at right angles to each other .... STAUROTHECA.
Hydrothecæ alternate, margins dentate. Operculum present .... SYMPLECTOSCYPHUS.
Branches not normally forming a network 4
4\. Branches arising from cavities of the hydrothecæ .... THECOCLADIUM.
Branches arising as usual from the stem 5
5\. Stem polysiphonic, the central tube bearing hydrothecæ .... GRAMMARIA.
Stem monosiphonic, or tubes differently arranged 6
6\. Minute cup-shaped bodies at the hydrothecal bases .... HYPOPYXIS.
No such appendages 7
7\. Hydrothecæ arranged in a single row .... HYDRALLMANIA.
Hydrothecæ arranged in more than a single row 8
8\. Hydrothecæ in two rows, adnate to each other in pairs .... DESMOSCYPHUS.
Hydrothecæ in two opposite rows, or in several rows 9
9\. Hydrothecæ in several longitudinal rows .... SELAGINOPSIS.
Hydrothecæ in two longitudinal rows 10
10\. Operculum present, composed of one or more parts 11
Hydrothecæ without operculum 15
11\. Operculum with more than two parts 12
Operculum with two parts 13
12\. Hydrothecæ usually alternate, and one to an internode .... SERTULARELLA.
Hydrothecæ opposite or alternate, several to each internode .... CALYPTOTHUJARIA.
13\. Hydrothecæ opposite 14
Hydrothecæ alternate, often several to an internode, an operculum present .... MONOPOMA.
14\. Hydrothecæ usually paired. Operculum hinged at a single point .... DIPHASIA.
15\. Hydrothecæ opposite, several pairs in the middle of each internode .... PASYTHEA.
One, two, or more hydrothecæ to each internode, the latter not much produced beyond the hydrotheca-bearing part 16
16\. Hydrothecæ strictly opposite, generally partly immersed, often without evident relation between hydrothecæ of opposite rows .... THUIARIA.
Hydrothecæ single, or in more or less distinct pairs on each internode 17
17\. Hydrothecæ paired, sometimes not strictly opposite. Distal part of branches usually with a pair to each internode. Gonangia on branches 18
Hydrothecæ single or paired. Gonangia springing from lumen of hydrothecæ .... SYNTHECIUM.
18\. Hydrothecal margin toothed. Hydrothecæ not conspicuously broader at base .... SERTULARIA.
Hydrothecal margin even or slightly sinuous. Hydrothecæ swollen at base .... ABIETINARIA.[2]

It will be noted that this scheme denies the presence of the operculum in the genera *Pasythea*, *Sertularia*, *Thuiaria*, and *Abietinaria*, in all of which it is actually present.

In 1893 there appeared a scholarly work by Prof. G. M. R. Levinsen,[3] in which a serious attempt is made to arrange the genera of the Sertularidæ on the basis of the characters of the operculum in connection with the condition of the hydrothecal margin.[4] This writer asserts that the operculum is found in all Sertularidæ, without exception, and carries his belief to the extent of casting out all genera that do not possess that structure. He states that the genera *Grammaria*, *Synthecium*, and *Hypopyxis* should all find their places outside of the Sertularidæ, an opinion in which I concur, except in the case of the genus *Synthecium*. He maintains that such features as the relation of the hydrothecæ to the hydrocaulus and to one another are of little sys-

[1] Die Hydroiden des k. k. naturhistorischen Hofmuseums, V, Vienna, 1890.

[2] See Kirchenpauer, Nordische Gattungen und Arten von Sertulariden, Hamburg, 1884, p. 29. Dr. Kirchenpauer recognizes the following genera: *Selaginopsis*, *Thuiaria*, *Abietinaria*, and *Sertularella*.

[3] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst tilligemed Bemærkninger om Hydroidernes Systematik. Særtryk af Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjøbenhavn, 1892, 1893.

[4] The writer is under great obligation to Mr. J. H. Paarmann for translating the systematic portion of Levinsen's work.

tematic value unless reenforced by the characters of the operculum and hydrothecal margin, upon which he chiefly relies in his system of classification. He maintains that there is a constant relation between these last two structures, and that the operculum is always attached to more or less deepened curves or sinuosities of the margin.

In accordance with this position, based, as the author expressly states, on his studies of the Greenland species only, Professor Levinsen in another work published during the same year (1893),[1] classifies the Sertularidæ as follows:

(a) Operculum of 3 or 4 flaps which are attached to a like number of emarginations of the walls of the hydrothecæ. Gonangia annulated.......... *Sertularella.*
(a′) Operculum of a single flap.
  (b) Margin of hydrotheca with two lateral teeth.
    (c) Hydrothecæ in a single zigzag row. Operculum adcauline.......... *Hydrallmania.*
    (c′) Hydrothecæ in two rows. Operculum attached to adcauline side of margin.......... *Sertularia.*
  (b′) Margin of hydrothecæ without teeth.
    (c) Operculum attached to adcauline side of margin.......... *Diphasia.*
    (c′) Operculum attached to abcauline side of margin.......... *Thuiaria.*

In applying this key to the large number of species discussed in the present work it becomes evident that it is inadequate to meet the requirements of the case, however well it applies to the Greenland forms discussed by Levinsen.

The scheme is so attractive at first sight that the writer must confess to a sense of personal disappointment at the failure of a method of classification for which he sincerely desired success. The following considerations, and several others could be added, are sufficient to show the inadequacy of the key.

In the genus *Sertularella* the form *S. formosa* Fewkes (Plate XXVII, fig. 2), has an absolutely even margin, and an operculum that, when present, is stretched like a drumhead over the very wide operculum. The same is true of *S. hartlaubi* Nutting. I can not see how either of these can be rightfully separated from the genus *Sertularella.*

The hydrothecal margins in *Hydrallmania* can seldom be said to have two teeth, and indeed are often perfectly oval, or with slight angulations at the sides that cannot properly be called teeth in the sense in which the term is used in reference to the margins of hydrothecæ.

Mr. Paarmann, who has very carefully studied many species of sertularians that would come under the genus *Sertularia*, according to the key given above (including *S. pumila* and other long-known forms), by means of serial sections concludes that Professor Levinsen is incorrect in saying that the operculum of this genus consists of a single flap. As this is a matter of unusual importance I quote from his unpublished manuscript:

In the species having bilabiate (bidentate) margins each of the emarginations is surmounted by a membranous piece of the operculum. Levinsen (p. 187) says that the adcauline piece is permanently attached to the margins of the teeth, thus forming a "collar," while the abcauline piece is a free functional flap which opens when the hydranth expands and closes after the hydranth has retracted. Upon this type he bases his genus *Sertularia.* The investigation of a large number of specimens by means of longitudinal and cross sections shows that this condition is by no means uniform. Sometimes the adcauline piece is attached while the other is free, and sometimes the reverse is true. Often the sides of a flap are attached for a greater or less distance proximally while they become free distally, the degree of attachment varying greatly even in the same species. In most cases both flaps are functional.

I have examined Mr. Paarmann's sections and am convinced that the statements above quoted are correct. It seems evident that Allman[2] and Marktanner-Turneretscher[3] are correct in interpreting the hydrothecæ of such species as *Sertularia pumila* as having a two-valved operculum.[4] This conclusion would make it necessary to fundamentally modify the table of classification proposed by Levinsen. But there is still another and even greater objection to relying exclusively

[1] Annulata, Hydroidnæ, Anthozoa, Porifera in: Det videnskabelige Udbytte af Kanonbaasen "Hauchs" Togter, Copenhagen, 1893, pp. 321–425.

[2] Memoirs of the Museum of Comparative Zoology, V, 1877, p. 25.

[3] Hydroiden des k. k. naturhistorischen Hofmuseums, Vienna, 1890, p. 238.

[4] It seems to me that even by Levinsen's account the operculum is here morphologically, although not functionally, two-valved, and that his so-called "collar" is, like the operculum, simply a thin membranous extension of the hydrothecal wall. See Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 186 *et seq.*

upon the characters of the margin and operculum in classifying the Sertularidæ, and that is that these characters are inconstant, not only in some of the genera, but also in some individual species. I have already pointed out the fact that certain species of *Sertularella* lack the supposed three or four flapped operculum. In *Selaginopsis mirabilis* (Verrill) there are two flaps to the operculum, while the one-flapped operculum is characteristic of the genus as a whole. I do not believe that any one would separate *S. mirabilis* and *S. cylindrica* (Clark) generically, and yet they differ in this feature upon which Levinsen bases his genera. In *Sertularia desmoides* Torrey, a form found on the Californian coast (Plate III, fig. 1), the hydrothecal margins are sometimes without teeth and at others show two small teeth. The operculum is usually of a single adcauline flap, but sometimes, in other parts of the same colony, is composed of two parts. In this case neither the margin nor the operculum furnishes a constant feature, even in a single colony. In *Abietinaria greenei* (Murray) the hydrothecæ on one part of a colony will be of the typical abietinarian form, while those on another part of the same colony will have two very conspicuous teeth, both of which are adcauline and not strictly lateral (Plate XXXVI, figs. 3 and 4). The operculum is of a single adcauline flap. Probably enough illustrations have been given to show that the characters used by Professor Levinsen are insufficient in themselves to furnish a basis for the classification of the Sertularidæ.

It by no means follows, however, that the operculum and hydrothecal margin are characters to be neglected. On the contrary, I think them most important aids in defining certain genera, such as *Abietinaria* and *Diphasia*, and feel that we owe much to Professor Levinsen for his painstaking work calling general attention to these features. Careful and conscientious work such as his is always valuable, whether the results are in all respects confirmed or not.

The only remaining author whose scheme of classification we need discuss at present is Dr. Karl Camillo Schneider, who published a work of interest in this connection.[1] Dr. Schneider (p. 521) was at first much impressed with Levinsen's method of classification, but decided that a review of the whole group revealed the inadequacy of the plan, and also many intergrading forms. On the whole, this writer prefers the older classification of the Sertularidæ, and adopts the following genera, but calls them "groups" on account of their incomplete separation: *Sertularella*, *Dynamena*, *Thuiaria*, *Pasythea*, *Selaginopsis*, and *Hydrallmania*.[2]

Lest it may appear that the writer has intentionally or carelessly neglected to include the works of American writers in the summary just given, attention is called to the fact that there has been no general work, nor any general discussion of the family Sertularidæ produced by an American writer since the appearance of the classic work by the elder Agassiz, in 1862,[3] *before* the appearance of Hincks's British Hydroid Zoophytes, 1868, which I have taken as my point of departure in the preceding discussion. Agassiz proposed three new genera of Sertularidæ (pp. 355–356): *Amphisbetia*, *Cotulina*, and *Amphitrocha*, which were not adequately defined, and which have not been adopted by later writers, except that two of them are used by his son, Dr. Alexander Agassiz.[4]

In attempting to break up the family Sertularidæ into genera, there are several principles that should be clearly grasped at the outset:

First. No one character, nor combination of two characters can be successfully used throughout, as is illustrated by Levinsen's attempt based on the characters of the hydrothecal margin and operculum.

Second. It sometimes happens that a single character will sharply differentiate a single genus. For example, the unilateral arrangement of the hydrothecæ in *Hydrallmania*.

Third. The hydroids are an extremely plastic group, and certain characters may occur sporadically in many unrelated species that occur normally and regularly in certain closely related forms. This fact has been the cause of great confusion in the systematic treatment of

[1] Hydroidpolypen von Rovigno, nebst Uebersicht über das System der Hydroidpolypen im Allgemeinen. Zoologische Jahrbücher, Systematik, X, pp. 472–555, Jena, 1898.

[2] Although Doctor Schneider calls these "groups" he treats them as genera, for convenience in handling.

[3] Contributions to the Natural History of the United States of America, IV, Boston, 1862.

[4] North American Acalephæ, 1865, pp. 146–147.

the subject, and has brought about the rejection of several genera which it would be convenient and reasonable to retain.

For instance, it occurs not infrequently in several widely different forms among the Sertularidæ that a gonangium will occasionally have its origin within the lumen of the hydrotheca, although these species normally produce gonangia in the ordinary position. But there are several species, otherwise closely related in the form of the hydrothecæ and in the apparent absence of the operculum, in which the gonangium normally and regularly springs from the inside of hydrothecæ.

Such species should, it seems to me, be placed in the genus *Synthecium* of Allman.[1] The sporadic appearance of the gonangium of the *Synthecium* type occurring as an abnormality in other nonrelated species which commonly produce gonangia in the ordinary way does not, in my opinion, invalidate the genus in the slightest degree.

Again, we find that in many species of the Sertularidæ, not otherwise closely allied, one or more branches spring from the lumen of hydrothecæ, although these species normally and regularly branch in the ordinary way. But Allman has found several specimens of a certain species in which the branches "invariably spring from the hydrothecæ,"[2] and for this species he instituted the genus *Thecocladium*. He afterwards found other colonies of the same species[3] that showed the same constant character, the branches arising normally and regularly from the lumen of the hydrotheca. These specimens, being more complete than the ones originally described, furnished additional characters that still further confirmed his judgment in establishing the genus. Here again, it seems to me, we are by no means justified in following those who would discard the genus *Thecocladium*, because species of widely different genera will sporadically exhibit the same peculiarity that is uniformly possessed by the specimens studied by Allman.

Fourth. The number of rows of hydrothecæ on the branches is a character by which groups of species otherwise closely related can be segregated to form genera that appear both convenient and natural. Thus we find a number of species closely related to each other and having manifest affinities to certain species of *Thuiaria* that are characterized by having the stem beset with more than two regularly disposed longitudinal rows of hydrothecæ. For such forms Allman has instituted the genus *Selaginopsis*.[4]

Again, there are two species closely allied to the genus *Sertularella* that agree more closely with each other than with other species from the fact that the hydrothecæ are placed on all sides of the branch in an ascending spiral. Associated with this character in the two species thus far discovered is a remarkable tendency toward anastomosis of the branches which are all in the same plane, forming a flabellate colony. For the first of these species Allman formed the genus *Dictyocladium*.[5] Another species is described in the present work. One species has been found, otherwise related to the genus *Sertularia*, that differs from all others in the fact that the successive pairs of hydrothecæ are rotated on the stem so that each pair is set at right angles to the plane of the pairs immediately above and below. The result is that there are four longitudinal rows of hydrothecæ on the hydrocaulus, the individuals of a given row being very widely separated, and each individual forms one of a pair of opposite hydrothecæ. For this species Allman has established the genus *Staurotheca*,[6] a genus not found in American waters.

Fifth. The operculum can be used as an important factor in separating out some of the generic groups from the great mass of Sertularidæ in which the hydrothecæ are arranged in two longitudinal rows, but this character is not in itself sufficient, and we find it necessary to use different combinations of two or more characters for this purpose, among which the combination of the form of the operculum and the arrangement of the hydrothecæ on the hydrocaulus is of great value. There is a certain long known form that has an operculum of two valves and in which

[1] Journal of the Linnæan Society, Zoology, XII, 1874, p. 365.

[2] Idem, XIX, p. 149.

[3] *Challenger* Report, Hydroida, Part 2, 1888, p. 81.

[4] Journal of the Linnæan Society, XII, 1874, p. 272.

[5] *Challenger* Report, Hydroida, Part 2, 1888, p. 76.

[6] Idem, Part 2, 1888, p. 75.

the hydrothecæ are arranged in compact groups of pairs, a group to each internode, the upper pair of a group being noticeably smaller and different in shape from the lower. This very characteristic form is the basis of the genus *Pasythea* of Lamouroux.[1]

A large number of species agree in having the operculum of three or four flaps and the hydrothecæ strictly alternate. These form the well marked and well known genus *Sertularella*.[2]

Again we find that a combination of the characters of the operculum together with the general form of the hydrothecæ can be used to advantage. A large number of species agree in having an operculum composed of a single flap which is hinged to the adcauline side of the margin. These have all been included by Levinsen in the genus *Diphasia*. A study of these forms leads to the discovery that the genus thus constituted is made up of two well-marked groups which agree in the character of the operculum just given, but differ widely in the form of the hydrothecæ; one group consisting of species with tubular hydrothecæ that are not distinctly swollen below, and that have very large apertures without any distinct neck or constriction of the distal part of the hydrothecal wall. These forms can very well be retained in the genus *Diphasia*, substantially as originally described by Agassiz. The other group having an operculum of one adcauline valve consists of species which differ from *Diphasia*, and agree among themselves in having hydrothecæ that are more or less bottle-shaped—that is, their lower portion is bulged out or swollen like the body of a flask, and their distal parts are constricted so that the diameter of the aperture is much smaller than the diameter of the lower portion. There is often also a distinct constriction caused by the thickening of the hydrothecal walls below the margin. The forms just described constitute what seems to me to be a very well circumscribed genus *Abietinaria*.[3]

Sixth. As a last resort we find that a combination of the position of the hydrothecæ, whether opposite or alternate, and the character of the internodes will serve to aid in solving the last and most perplexing problem of all, the separation into generic groups of the forms still remaining, which agree in having the hydrothecæ in two rows, margins smooth or dentate, the operculum of one adcauline flap, or of two (very rarely three) flaps.[4] We find upon examination of the very large number of species agreeing in these particulars a number that agree in having strictly opposite hydrothecæ that are not greatly embedded in the hydrocaulus, an operculum comprised almost always of two valves, and the internodes normally and commonly bearing two hydrothecæ; or the hydrothecæ may be slightly subopposite, but the internodes are regular and normally and commonly bear two hydrothecæ, showing that the latter are essentially paired, as pointed out by Bale.[5] Such forms can be referred to the original genus of the family, *Sertularia*.

The remaining forms agree in having the hydrothecæ normally and regularly subopposite to alternate, usually more or less embedded in the hydrocaulus; operculum of one flap (abcauline) or of two flaps; more than two (often many) hydrothecæ to each internode, the latter being of very irregular length even in the same colony. These forms we can refer to the old genus *Thuiaria*.

It will be noticed that seven of the nineteen genera admitted by Marktanner-Turneretscher (see p. 39) are not included in the scheme as outlined above. These seem to me to be untenable, and the species included in them can be disposed of as follows:

Grammaria and *Hypopyxis* do not belong to the Sertularidæ.

Calyptothuiaria and *Symplectoscyphus* should be united with *Sertularella*, from which they are not separated by what appear to me to be adequate characters.

Monopoma is quite a typical *Thuiaria*, according to the scheme here adopted.

Desmoscyphus can with propriety be referred back to the old genus *Sertularia*.

[1] Nouveau bulletin philomatique, décembre, 1812, p. 183.

[2] Gray, Radiata, List of specimens of British animals, etc., London, 1847, p. 68.

[3] Kirchenpauer, Nordische Gattungen und Arten von Sertulariden, Hamburg, 1884, p. 29.

[4] The author does not claim to have successfully solved this problem, which appears with our present knowledge to be insoluble, but hopes that the arrangement suggested will be practical in fact, although unsatisfactory in theory. At any rate, it is the best that he has been able to devise after very careful pondering of the subject.

[5] Australian Hydroid Zoophytes, 1884, pp. 115, 116.

Dynamena should be dismembered, part of the species going to *Sertularia* and part to *Thuiaria*, as above defined.

For convenience in referring specimens of American Sertularidæ to their proper genera, according to the plan adopted in this work, the following key is presented, with the confession that, like all such keys, it is purely artificial and does not indicate the interrelationships of these genera:

KEY TO THE GENERA OF AMERICAN SERTULARIDÆ.

Hydrothecæ all on one side of the branches, their distal ends being turned alternately to the right and left .... *Hydrallmania.*
Hydrothecæ arranged on all sides of branches.
  Operculum of one adcauline flap, no anastomosis of branches .... *Selaginopsis.*
  Operculum of several flaps, branches freely anastomosing .... *Dictyocladium.*
Hydrothecæ arranged in pairs, each pair being revolved so as to be at right angles to the pair immediately above and below .... (*Staurotheca.*)[1]
Hydrothecæ always in two longitudinal rows.
  Hydrothecæ in groups of pairs, the uppermost being decidedly smaller than the lower .... *Pasythea.*
  Operculum adcauline, and of one flap.
    Hydrothecal aperture large, body not flask-shaped .... *Diphasia.*
    Hydrothecal aperture small, body flask-shaped .... *Abietinaria.*
  Operculum abcauline, of one flap, or of two or more flaps.
    Operculum of three or four pieces.[2] Hydrothecæ strictly alternate, margin usually toothed .... *Sertularella.*
    Operculum of one (abcauline) flap, or of two, rarely three,[3] flaps.
      Hydrothecæ strictly opposite, each internode normally bearing a single pair .... *Sertularia.*
      Hydrothecæ subopposite to alternate, each internode normally bearing more than two .... *Thuiaria.*
  Operculum wanting, margin round.
    Branches normally arising from the lumen of a hydrotheca .... (*Thecocladium.*)
    Gonangia normally arising from the lumen of a hydrotheca .... *Synthecium.*

In concluding this general discussion of the genera of the Sertularidæ the author wishes to explain his position in view of some of the more important objections which he apprehends will be urged against the classification here adopted.

First. It will be said, and truthfully, that the system is based on a heterogeneous set of characters, and that different characters are used in defining certain genera from those used in defining others. Of course, the ideal system would be to find one or two characters that would suffice. As a matter of fact, no writer could use more care and ability to effect this end than has Levinsen, as we have seen; and his work has been chiefly valuable in demonstrating the impossibility of such a method, at least so far as the Sertularidæ are concerned. There is also a distinct danger in confining diagnostic features within too constricted limits, and this is that it is almost certain to result in a most unnatural assemblage of species into genera which do violence to actual affinities, as was done, for instance, when *Hydrallmania* was regarded as a plumularian on account of using the one character of unilateral arrangement of hydrothecæ.

With increase in experience the naturalist sees more and more clearly that all characters must receive due consideration, and that the fewer the characters used the less satisfactory will be his groups, if he desires them to indicate real affinities.

Again, it has come to be recognized among systematists that a given character will often be of the greatest value in one section of a family, or other group, while the same character is comparatively worthless in another section of the same family or group. Thus the operculum is almost an ideal character to use in separating out the genus *Diphasia*, as used by Levinsen, but fails in *Thuiaria* and *Sertularia*.

Second. A still more serious objection will doubtless be raised by those who will discover intergrading forms between the genera that are here recognized.

[1] The brackets indicate that the genus is not found in American waters.

[2] Very exceptionally the hydrothecæ in this genus are without teeth, and the operculum is stretched like a drumhead across the very wide, round aperture.

[3] When three teeth are present, as in some of the *Desmoscyphus* group of *Sertularia*, the upper one is much smaller than the others, and the operculum is very delicate, while the three-toothed forms of *Sertularella* have equal and equidistant or conspicuous teeth, and the operculum is evident.

In answer to this it must be urged that a condition, not a theory, confronts us, and it appears to be impossible to break up the family Sertularidæ into groups that do not intergrade to some degree. Reducing the number of genera will not help us, a statement that will be confirmed by again turning to Levinsen's attempt, in which he recognized but five of the nineteen genera used by Marktanner-Turneretscher. Investigation shows that these five genera intergrade just as vexatiously as do the twelve included in my scheme, and the five genera are individually much more unwieldy and difficult to manage than are the twelve. Thus there is nothing lost in the delimitation of genera, and much gained in convenience when the larger number is utilized.

Here again the plasticity of the Hydroida as a group is the cause of much of our difficulty. It seems that these lowly animals have not yet crystallized into definite and unvarying forms to the extent that is found among the higher metazoa, and the result is that both specific and generic boundary lines are crossed in various directions, much to the perplexity of the systematist, as I have elsewhere attempted to illustrate.[1] In this case it seems to me that we must abandon the idea that a genus is untenable so long as there is any intergradation with other genera, and take the position that a genus is simply a group of closely related species that are related more nearly to each other than to members of other similar groups, and that the genus can be good, both in practice and in theory, even if certain species do intergrade in some individual characters with species of other genera. We must remember, moreover, that all genera would intergrade with other genera, were a complete record accessible, and that generic distinctions must necessarily be an expression of the gaps in our knowledge rather than of natural boundary lines.

I have taken the position indicated above in this work, and frankly confess that some of the genera used intergrade with others. These intergradations will be pointed out with care when the several genera are discussed later.

Distribution of American Sertularidæ.

	Geographical.															
	American.									European.						Bathymetric, in fathoms.
	Atlantic.						Pacific.									
	Canadian region.	North Atlantic region.	West Indian region.	Brazilian region.	Patagonian region.	Arctic region.	Alaskan region.	Californian region.	South Pacific region.	Scandinavian region.	British region.	Continental region.	Mediterranean region.	Siberia and Japan.	Australasia.	
Abietinaria abietina	+	+				+	+			+	+	+	+			1-55
alexanderi							+									[illegible]
amphora							+									56-171
anguina							+	+								34-72
annulata							+									3.
coei							+									Shallow water.
compressa														+		Shallow water.
costata							+									Shallow water.
filicula	+	+				+	+	?+		+	+					1-165
gigantea							+									26-40
gracilis							+									40-283
greenei							+	+								Shallow water.
inconstans							+									Shallow water.
traski							+									[illegible]
turgida							+									[illegible]
variabilis							+									1-171
Dictyocladium flabellum							+									27-72
Diphasia corniculata								+								Shallow water.
digitalis			+	+											+	5¼-78
fallax	+	+				+				+	+					1-1210
kincaidi							+									Shallow water.
paarmanni				+												291-440
pulchra							+									67
rosacea	+	+				+				+	+					1-47
tamariska	+					+				+	+	+	+			1-660
tropica			+													Shallow water.

[1] C. C. Nutting. Address of the chairman of the Section of Zoology and vice-president of the American Association for the Advancement of Science. Science, January 9, 1903, p. 9.

Geographical distribution of American Sertularidæ—Continued.

	Geographical.															Bathymetric, in fathoms.
	American.									European.						
	Atlantic.						Pacific.									
	Canadian region.	North Atlantic region.	West Indian region.	Brazilian region.	Patagonian region.	Arctic region.	Alaskan region.	Californian region.	South Pacific region.	Scandinavian region.	British region.	Continental region.	Mediterranean region.	Siberia and Japan.	Australasia.	
Hydrallmania distans							+	+								Shallow water.
falcata	+	+				+				+	+	+				1-1100
franciscana								+								Shallow water.
Pasythea quadridentata			+	+											+	[1] Pelagic.
Selaginopsis alternitheca						+										[2] 100
cedrina							+									Shallow water.
cylindritheca							+									1-41
hartlaubi							+									43
mirabilis	+	+				+	+			+						1-40
obsoleta						+	+									Shallow water.
ornata							+									45
pinaster						+	+									Shallow water.
pinnata						+	+									23-25
plumiformis							+									?
triserialis							+	+						+		1-31
Sertularella albida							+									6-20
allmani					+											21
amphorifera			+													101-471
areyi			+													100-200
catena			+													390
clarkei							+									?
clausa				+												600
complexa							+									56-121
conica			+				?+	?+								25-505
contorta					+											?
cylindritheca			+	+												6-40
dentifera								+								Shallow water.
distans			+													1-167
elegans							+									72
episcopus					+										+	Shallow water.
filiformis					+											9
formosa			+													6-357
fusiformis	+							+			+		+		?+	1-200
gayi	+	+	+	+	+	+				+	+	+	+			[3] 1-552
geniculata						+										?
gigantea						+										?
hartlaubi			+	+												33-52
lata				+											+	1-77°
levinseni							+									56
magellanica				+	+											49.4
magna							+									283
margaritacea					+											Pelagic.
megastoma			+													167
meridionalis					+											122
milneana					+											20-21
minuta							+									283
nana							+									Shallow water.
patagonica					+											Shallow water.
picta					+											Shallow water.
pinnata							+									1-112
pinnigera			+													3-4
polyzonias	+	+	+	+	+	+	+		+	+	+	+	+		+	[4] 1-352
quadrata			+													67-191
quadrifida				+												128
rugosa	+	+	+			+	+			+	+	+				1-58
sieboldi			+													?
solitaria			+													13
subdichotoma					+										+	21
tanneri							+									40
tenella			+	+		+	+	+		+	+	+			+	1-169
tricuspidata	+	+				+		+		+	+	+				1-1375
tropica									+							450-1168
turgida							+	+						+		1-201
Sertularia bispinosa					+										+	[5] Shallow 1 to 50.5
brevicyathus			+													10-150
challengeri				+											+	38-40
cornicina		+	+													Shallow water.
desmoides								+								1-42
exigua			+													9
flowersi			+													150
gracilis		+						+			+					Shallow water.
mayeri		+	+													14-20
operculata					+					+	+	+	+		+	[6] 10-150
pourtalesi		+	+													1-67
pulchella					+			+								1-24
pumila	+	+				+	+	+		+	+	+	+			[7] 1-165

[1] West coast Africa, South Seas.
[2] Davis Straits.
[3] Cape of Good Hope.
[4] Azores, Red Sea, Cape of Good Hope.
[5] New Zealand.
[6] Azores.
[7] New Zealand?

Geographical distribution of American Sertularidæ—Continued.

	Geographical.															
	American.									European.						
	Atlantic.						Pacific.									
	Canadian region.	North Atlantic region.	West Indian region.	Brazilian region.	Patagonian region.	Arctic region.	Alaskan region.	Californian region.	South Pacific region.	Scandinavian region.	British region.	Continental region.	Mediterranean region.	Siberia and Japan.	Australasia.	Bathymetric, in fathoms.
Sertularia rathbuni																27
stookeyi			+													Shallow water.
tumida			+													Shallow water.
versluysi			+													Pelagic to 30.
Synthecium cylindricum								+							+	5-12
marginatum																324
rectum			+													100-276
robustum					+											21
tubithecum			+													18-111
Thuiaria argentea	+	+				+	+	+		+	+	+				1-55
cupressina	+	+				+	+	+		+	+	+	+			1-160
dalli							+									1-13
diffusa		+														[1]1-16
elegans																?
fabricii						+	+									1-18
immersa						+										?
kurilæ							+									?
latiuscula	+	+														Shallow water.
lonchitis	+	+				+	+			+	+	+				?
plumosa						+	+									30-75
plumulifera																7-70
polycarpa									+							?
ramosissima		+														?
robusta						+	+									13-51
similis							+									13-72
tenera						+	+			+						1-165
thuiarioides						+	+									11-21
thuja	+	+				+	+			+	+	+				1-110
tubuliformis			+	+												Shallow water.

[1]South America.

On account of the very marked difference between the distribution of the Sertularidæ and that of the Plumularidæ, it seems best to adopt a different classification of geographical regions from that presented in the first part of this work.[1] The two groups have entirely different centers of distribution, and the Plumularidæ are almost wanting in regions where the Sertularidæ are most abundant. I have therefore adopted for the latter family the following regions:

CANADIAN.—To include the North American coast region from Eastport, Maine, to the Arctic Circle, or the south end of Greenland.

NORTH ATLANTIC.—From Eastport, Maine, to Charleston, South Carolina.

WEST INDIAN.—Including region south of Charleston, the Gulf of Mexico, Caribbean Sea, North coast of South America to Brazil.

BRAZILIAN.—From Northern Brazil to Southern Argentina.

PATAGONIAN.—Southern Argentina, Patagonia, Terra del Fuego, Falkland Islands, and Southern Chile.

ARCTIC.—All north of Arctic Circle in general, but including the White Sea of Russia.

ALASKAN.—From Bering Straits south to and including Puget Sound.[2]

CALIFORNIAN.—From Puget Sound to and including Mexico.

SOUTH PACIFIC.—South of Mexico to the Patagonian region as here defined.

SCANDINAVIAN.—Including Denmark, Sweden and Norway to the Arctic Circle.

BRITISH.—Including the British Islands and Helgoland.

CONTINENTAL.—Including the coasts of Belgium, France, and Atlantic coast of Spain.

[1] American Hydroids, Part I, The Plumularidæ, Washington, 1890, p. 49.

[2] See Hydroids from Alaska and Puget Sound, C. C. Nutting, Proceedings U. S. National Museum, XXI, 1899, p. 742; also Papers from the Harriman Alaska Expedition, The Hydroids, Proceedings Washington Academy of Sciences, III, 1901, pp. 158 to 162.

Mediterranean.—Including the Mediterranean proper and the Adriatic.

The other regions named are self-explanatory. The few cases where American species are found in regions not mentioned above are indicated in footnotes.

It will be seen that most of these regions are quite arbitrary, and their faunæ intergrade in almost all cases. Until a more serious and comprehensive study is made of the distribution of all groups of marine organisms no final or even approximately satisfactory set of zoogeographical regions can be made. In the meantime, however, each worker can exercise his own judgment in devising a scheme that will satisfy his special requirements and aid him in indicating the facts of distribution so far as his field of work is concerned. It remains for some master mind to correlate these various attempts into a well-digested zoothalassography.

The table given above will serve to indicate some points of interest, the most notable being the richness of the sertularian fauna in the Alaskan region, in which 58 of the 131 species of American forms are found. This may be due to the excellent work done in that region, beginning with the extensive collections made by Dr. Dall and his party,[1] and terminating with the notable collections made by the Harriman Alaska Expedition.[2] In the meanwhile the U. S. Fish Commission steamer *Albatross* made very extensive collections during her several cruises in Alaskan waters, the material of which is included in the present work.

Next to this region come the West Indian and the Arctic, with 35 and 29 species. An examination of the table clearly reveals another fact, and that is that the sertularian fauna seems to have its present center of distribution in the far north, probably in the Arctic regions, as is indicated by the holarctic distribution of many species—a matter that the present writer has already discussed.[3]

In working with material from the far north, particularly from Alaska, one is greatly impressed with the luxuriance and thrifty appearance of the hydroids—an indication that the region is peculiarly adapted to their needs. The finest specimens, both of campanularian and of sertularian colonies, that the writer has ever seen came from the cold waters of Alaska. The various Scandinavian writers have found a rich field for work in the hydroids, and Kristine Bonnevie has produced a sumptuous monograph on the Hydroids of the Norwegian North Atlantic Expedition. It seems, then, that the group has spread from the Arctic region southward on both shores of the Atlantic and on the Pacific coast of North America, and there are so many species common to these four regions that we can hardly escape the conclusion that the group, at least in its present forms, had a polar origin. The number of species found in the West Indian region would seem to militate against this view, but many of these belong to special groups, such as the *Desmoscyphus* group of *Sertularia*, indicating that they have long been separated from the ordinary types of the family. The Sertularidæ appear to have spread, from whatever center, over the ocean floor throughout the world; at least they have been found in every region where any considerable amount of dredging has been done. They must be quite abundant in the Patagonian region, for the small amount of collecting done there has given us no less than seventeen species. Australia also has a rich sertularian fauna of about sixty species, according to Bale,[4] which seems to be rather closely allied to the Patagonian forms, indicating the possibility of an Antarctic center of distribution, for certain groups at least. The west coast of South America seems to be the poorest in Sertularidæ of all the American regions included in the table. This may be due to the comparatively few hauls made in these waters, but probably indicates a real dearth in that region.

It is interesting to note the great difference shown in this table and the one on pages 49 to 51 of Part I of this work between the distribution of the Sertularidæ and the Plumularidæ, the former having its greatest wealth of material in the Alaskan region and the latter in the West Indies.

[1] See Clark, Report on the Hydroids collected on the Coast of Alaska and the Aleutian Islands by W. H. Dall, Proceedings, Academy of Natural Sciences of Philadelphia, 1876.

[2] See Papers from the Harriman Alaska Expedition, XXI, The Hydroids, C. C. Nutting, Proceedings Washington Academy of Sciences, III, 1901, p. 157.

[3] Hydroids of the Harriman Expedition, 1901, p. 162.

[4] Catalogue of the Australian Hydroid Zoophytes, W. M. Bale, Sydney, 1884.

Bathymetric distribution.—Here again it has seemed best not to follow the scheme adopted in discussing the Plumularidæ, on account of the great preponderance of shallow water forms in the Sertularidæ, and also for the reason that the table given for the Plumularidæ involved more labor than is necessary in the case of other species. By giving the maximum and minimum depth at which each species is found it is thought that the table will be as useful as that given for the Plumularidæ, in which the record is maintained for all the intermediate zones, it being, indeed, more probable that the actual conditions of bathymetric distribution are thus presented, as it is altogether more likely that the nonoccurrence of a species in the table given for the Plumularidæ is due to incomplete exploration than that the bathymetric distribution of these species is actually discontinuous, as would be indicated by that table. In other words, we have a right to consider that a species that has been reported from 100 and 300 fathoms actually exists somewhere at a depth of 200 fathoms, or that it has recently existed at that depth.

In comparing the two tables it becomes at once apparent that the Sertularidæ are much more generally found in shallow water than the Plumularidæ. The proportion of shallow-water forms—that is, those found in less than 50 fathoms—being a little over 75 per cent in the Sertularidæ and 50 per cent in the Plumularidæ. There are 41 per cent of the Sertularidæ confined to the shallow-water zone, while there are only 33 per cent of the Plumularidæ confined to the same zone.

The following table shows very plainly the difference in the bathymetric distribution between the two families:

Comparative distribution at increasing depths.

Family.	Less than 50 fathoms.	Over 50 fathoms.	Over 100 fathoms.	Over 150 fathoms.	Over 200 fathoms.	Over 500 fathoms.	Over 1,000 fathoms.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Plumularidæ	0.50	0.63	0.49	0.40	0.28	0.05	0.03
Sertularidæ	.75	.40	.30	.26	.16	.06	.03

The following species of Sertularidæ have been dredged at depths greater than 500 fathoms: *Diphasia fallax*, 1,210 fathoms (Bonnevie); *Diphasia tamariska*, 660 fathoms (Bonnevie); *Sertularella clausa*, 600 fathoms (Allman); *Sertularella tricuspidata*, 1,375 fathoms (Bonnevie); *Sertularella tropica*, 1,168 fathoms (Clarke).

The well-known *Sertularella tricuspidata* seems to have the greatest vertical distribution of any sertularian, ranging from the littoral region to the depth of 1,375 fathoms. The only American hydroid that has been found at a greater depth than this is *Aglaophenopsis verrilli* Nutting, which was found at 1,742 fathoms. In this case, however, the known bathymetric range is from 1,497 to 1,742 fathoms.[1]

SERTULARIA Linnæus (modified).

Trophosome.—Hydrothecæ in strictly opposite or rarely subopposite pairs. Stem and branches normally divided into regular internodes, each of which bears a pair of hydrothecæ, but sometimes there are more than one pair to the internode, in which case the hydrothecæ are strictly opposite. Operculum normally of two flaps.

Gonosome.—Gonangia oval or ovate, with a short collar and broad aperture and no internal marsupium. An acrocyst is occasionally present.

This being the original Linnæan genus for the hydroids, it has necessarily suffered many vicissitudes, most of which have been in the direction of closer and closer delimitation, Lamouroux leading by separating what are now known as the Plumularidæ and also breaking the Sertularians proper into two groups, *Dynamena* to include those with strictly opposite hydrothecæ, and *Sertularia* those with more or less alternate hydrothecæ.[2] Were both these genera used in the present work, the species that I include in *Sertularia* would go into the genus *Dynamena*. Lamouroux also set aside the species now included in the Halecidæ in the genus *Thoa*, afterwards

[1] See Part I, p. 49.

[2] Bulletin philomatique, 1812.

supplanted by *Halecium* of Oken,[1] the species now included in the Lafoeidæ in his genus *Lafoea;* many of the Campanularidæ in *Laomedea* and *Clytia*. At nearly the same time (1816) Lamarck issued the first edition of his classic work, Histoire naturelle des animaux sans vertèbres, II, in which he separated most of the present Campanularidæ under the name *Campanularia*, and the Plumularidæ under the names *Antennularia* and *Plumularia*, and retained the name *Sertularia* for the species then known that would now be included in the family Sertularidæ. In the same year, (1816),[2] Lamouroux published his Histoire des Polypiers coralligènes Flexibles, etc., in which he divided the sertularians into the genera *Pasythea*, which included the *Pasythea* of subsequent authors plus certain nonrelated forms, *Dynamena*, including the forms that would be placed in *Sertularia* and *Diphasia* in the present work, and *Sertularia*, including forms with alternate hydrothecæ, such as are now placed in *Sertularella*, *Thuiaria*, *Abietinaria*, etc.

The next work of importance is that of Fleming,[3] who instituted the genus *Thuiaria* to include what now would be called the typical species of that group. He followed Lamouroux in the use of the generic name *Dynamena*.

Johnston in his British Hydroid Zoophytes, 1828, returns to the use of the genus *Sertularia* in nearly its original meaning, drops the genus *Dynamena*, and adopts the genus *Thuiaria* of Fleming.

In 1862 Louis Agassiz[4] differentiated the genus *Diphasia* from the *Sertularia* or *Dynamena* of other writers, and uses the word *Sertularia* in a very restricted sense, including only *Sertularia argentea*, *Thuiaria cupressina*, *Abietinaria abietina*, and *A. filicula*. He also proposed the genera *Amphitrocha* and *Cotulina* for certain species that are now included in *Sertularella*, and *Amphisbetia* for *Sertularia operculata*.

With the great work of Hincks, British Hydroid Zoophytes, 1868, what may be called the modern era began. He reinstated and modified the genus *Sertularella*,[5] which is by far the largest in the family, if not in the entire order Hydroida, and also proposed the genus *Hydrallmania* for the *Sertularia falcata* Linnæus, which many writers had erroneously placed in the Plumularidæ.

The further vicissitudes of the genus *Sertularia* are sketched in preceding pages of the present work, in connection with the general systematic discussion of the family.

POINTS OF INTERGRADATION BETWEEN SERTULARIA AND OTHER GENERA.

As above defined, the genus *Sertularia* is a well circumscribed group, but in certain individual characters it has points of contact with other genera, among which the following may be found in species treated in this work:

First. With *Thuiaria*. In several cases, such as *S. bispinosa*, *challengeri*, and *desmoides*, the internodes are of irregular length and bear more than a single pair of hydrothecæ. In all such cases, however, the hydrothecæ are normally strictly opposite, and never subopposite nor subalternate, as in *Thuiaria*.

Second. With *Sertularella*, in having a three-flapped operculum and three-toothed margin, as in *S. sertularioides* and *S. brevicyathus*. Here, also, the hydrothecæ are strictly opposite and not strictly alternate, as in *Sertularella*.

Third. With *Thuiaria*, in having a round aperture, without teeth, and an abcauline operculum composed of a single flap as in *S. desmoides*. Here, also, the hydrothecæ are strictly opposite. In this case there is the further complication of extreme variability in the hydrothecal margin and operculum, there being an occasional hydrotheca in which the margin is obscurely two-toothed, and the operculum apparently of two valves. In each of these cases it

[1] Lehrbuch der Naturgeschichte, 1815, p. 91.

[2] The nearly simultaneous appearance of the works of Lamouroux and Lamarck have caused almost inextricable confusion in the systematic treatment of this and of other groups of hydroids. See Part I, p. 54.

[3] A History of British Animals, etc., Edinburgh, 1828, p. 545.

[4] Contributions to the Natural History of the United States, IV, 1862, p. 355.

[5] Originally proposed by Gray. List of the specimens of British animals in the collections of the British Museum, Part 1, Radiated Animals. London, 1847, p. 68.

will be observed that the species is, on the whole, more closely allied to *Sertularia* as here defined than it is to the particular genus to which it approximates in the special character discussed.

KEY TO AMERICAN SPECIES OF SERTULARIA.

Colony branched, at least in typical specimens.
  Branches regularly disposed.
    Branches opposite .... *pumila.*
    Branches alternate.
      Hydrothecæ largely contingent in front .... *versluysi.*
      Hydrothecæ seldom contingent in front .... *challengeri.*
  Branches loosely or irregularly disposed.
    Hydrothecal teeth two, long, recurved, conspicuous.
      One tooth much longer than the other........ *operculata.*
      Teeth approximately equal.
        Gonangium with two lateral spines .... *bispinosa.*
        Gonangium without spines........ *pulchella.*
    Hydrothecal teeth not conspicuous.
        Margin generally without teeth........ *desmoides.*
        Margin with three unequal teeth .... *rathbuni.*
        Margin with two opposite teeth........ *gracilis.*
Colony normally unbranched (one or two unsymmetrical branches may be present).
  Hydrothecæ placed on front of stem, and largely contingent.
    Hydrothecæ on proximal portion differing greatly from those on distal portion........ *mayeri.*
    Hydrothecæ alike on all parts of stem.
      Chitinous processes projecting downward from bottom of hydrothecæ .... *cornicina.*
      No noticeable chitinous processes.
        Colony and hydrothecæ of average size for this genus........ *pourtalesi.*
        Colony and hydrothecæ very small, less than half the size of preceding species .... *stookeyi.*
  Hydrothecæ not placed on front of stem, whether contingent or not.
    Hydrothecæ contingent of average size, margin with three teeth........ *brevicyathus.*
    Hydrothecæ contingent, very small, margin with three teeth .... *flowersi.*
    Hydrothecæ not contingent, margin two-toothed.
      Distal part of hydrothecæ bent at right angles to proximal part .... *tumida.*
      Distal part bent at much less than a right angle to proximal part .... *exigua.*

SERTULARIA PUMILA Linnæus.[1]

(Plate 1, figs. 1–3.)

Sea-Oak Coralline Ellis, Essay Nat. Hist. Corallines, 1755, p. 9.
Sertularia pumila Linnæus, Systema Naturæ, 1758, p. 807.
Sertularia pumila Linnæus, Fauna Suecica, 1761, p. 540.
Sertularia pumila Houttuyn, Natuurlyke historie, XVII, 1761–1773, p. 527.
Sertularia pumila Pallas, Elenchus zoophytorum, 1766, p. 130.
Sertularia pumila Linnæus, Systema Naturæ, 12th ed., 1767, p. 1306.
Sertularia pumila Boddaert, in Pallas, Lyst der Plant-Dieren, 1768, p. 162.
Sertularia pumila Ellis, An account of the Actinia sociata, etc., 1768, p. 434.
Sertularia pupa Maratti, De Plantis Zoophytis, etc., 1776, p. 25.

[1] The writer desires here to acknowledge his great indebtedness to a work written by Prof. Maurice Bedot, entitled Matériaux pour servir à l'histoire des Hydroides, published in Revue Suisse de Zoologie, Annales de la Société Zoologique Suisse et du Musée d'histoire naturelle de Genève. Genève. 1901.

This work is invaluable to the systematist in the hydroids, as it gives a very complete bibliography of the group up to the year 1820. Desiring to make the bibliography and synonymy of the Sertularidæ as complete as possible, the present writer has included a number of references that he has not personally verified, taken from the work of Bedot. In a great majority of cases the references have been verified, and it has thus been demonstrated that Professor Bedot's work has been very carefully done and is entirely reliable.

This has made it possible to include other references found in Bedot's work that I have been unable to verify. I feel confident that the number of errors thus admitted will be found to be certainly no greater than would have been found if I had personally verified every reference.

On page 143 will be found a list of works that are cited in the following pages, but which I have been unable to consult. It will be understood that all of the references to these works are on the authority of Bedot, unless otherwise stated.

Sertularia pumila Gronovius, Zoophylacium gronovianum, Pt. 3, 1781, p. 357.
Sertularia pumila Cavolini, Fil. Memoire per servire alla storia dei Polipi marini, 1785, p. 216.
Sertularia pumila Ellis and Solander, Nat. Hist. Zoophytes, 1786, p. 40.
Sertularia pumila Wilkins and Herbst, in Pallas, Characteristik der Thierpflanzen, 1787, p. 169.
Sertularia pumila Gmelin, in Linnæus, Systema Naturæ, 13th ed., 1788–1793, p. 169.
Dynamena pumila Esper, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 196.
Sertularia pumila Berkenhout, Synop. Nat. Hist. Great Britain, I, 1789, p. 215.
Sertularia pumila Olivi, Zoologia Adriatica, 1792, p. 288.
Sertularia pumila Esper, Fortsetzungen der Pflanzenthiere, II, 1794–1806, p. 10.
Sertularia pumila Bosc, Hist. naturelle des Vers, 1802, p. 195.
Sertularia pumila Turton, British Fauna, 1807, p. 212.
Sertularia tamarisca Bertoloni, Rariorum Italiæ plantarum decas tertia, 1810, p. 106.
Sertularia pumila Jameson, Catalogue of animals of the class Vermes, 1811, p. 564.
Dynamena (Sertularia) pumila Lamouroux, Nouv. Bullet. des Sc. par la Soc. philomatique, III, 1812, p. 184.
Nigelastrum (Sertularia) pumila Oken, Lehrbuch der Naturgeschichte, Pt. 3, 1815, p. 93.
Sertularia pumila Lamarck, Hist. Nat. des Anim. sans Vert., II, 1816, p. 119.
Dynamena pumila Lamouroux, Hist. des Polypiers, 1816, p. 179.
Sertularia pumila Stewart, Elements of the Natural History of the Animal Kingdom, 2d ed., II, 1817, p. 441.
Sertularia pumila Bertoloni, Specimen zoophytorum Portus Lunæ, 1819, p. 268.
Sertularia pumila Lamarck, Hist. Nat. des Anim. sans Vertèbres, 2d ed., 1836, p. 145.
Sertularia pumila Hassall, Ann. and Mag., VI, 1841, p. 168.
Sertularia pumila Hassall, Ann. and Mag., VII, 1841, p. 284.
Sertularia pumila Macgillivray, Ann. and Mag., IX, 1842, p. 463.
Sertularia pumila Gray, List British Animals, 1847, p. 70.
Sertularia pumila Johnston, Hist. Brit. Zoophytes, 2d ed., 1847, p. 66.
Sertularia pumila Alder, Catalogue Zoophytes Northumb., 1857, p. 24.
Dynamena pumila Agassiz, L., Contrib. Nat. Hist. U. S., IV, 1862, p. 326.
Dynamena pumila Packard, Canadian Naturalist, Dec., 1863, p. 4.
Dynamena pumila Kirchenpauer, Neue Sertulariden, 1864, p. 8.
Dynamena pumila Agassiz, A., North American Acalephæ, 1865, p. 141.
Dynamena pumila Van Beneden, Faunæ litorale de Belgique, 1866, p. 186.
Sertularia pumila Hincks, British Hydroid Zoophytes, 1868, p. 260.
Sertularia pumila Verrill, Invert. Vineyard Sound, 1871–2, p. 732.
Sertularia pumila Sars, Bidrag til Kundskaben, 1873, p. 49.
Sertularia pumila Verrill, Proc. Amer. Assoc. Adv. Sci., 1873, pp. 370, 374.
Sertularia pumila McIntosh, Ann. and Mag., 4th ser., XIII, 1874, p. 212.
Sertularia pumila Verrill, Amer. Journ. Sci. and Arts, VII, 1874, p. 133.
Sertularia pumila Schulze, Nordsee Exped., 1874, p. 132.
Sertularia pumila Coughtrey, Ann. and Mag., 4th ser., XVII, 1876, p. 29.
Sertularia pumila Clark, Hydroids of the Pacific Coast, 1876, p. 251.
Sertularia pumila Mereschkowsky, Ann. and Mag., 5th ser., I, 1878, p. 323.
Sertularia pumila Winther, Om Internodiets, etc., 1879–80, p. 304.
Sertularia pumila Winther, Fortignelse di i Danmark Hydr., 1880, p. 245.
Sertularia pumila De Varenne, Sur la Reproduction des Polypes Hyd., 1882, p. 27.
Sertularia pumila Weismann, Entstehung der Sexualzellen, 1883, p. 169.
Dynamena pumila Marktanner-Turneretscher, Hydroiden des k. k. naturhist. Hofmus., 1890, p. 239.
Sertularia pumila Bourne, Hydroids of Plymouth, 1890, p. 396.
Sertularia pumila Driesch, Tektonische Studien, 1890, p. 213.
Sertularia pumila Fewkes, Guide to Collector, 1891, p. 39.
Sertularia (Dynamena) pumila Levinsen, Medusæ, Ctenophorer, etc., 1892, p. 50.
Sertularia pumila Levinsen, Det Vidensk, Udbytte af Kanonbaaden "Hauchs" Togter, 1893, p. 370.
Sertularia pumila Crawford, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularia pumila Hartlaub, Hydromedusen Helgoland, 1897, p. 451.
Sertularia pumila Bonnevie, Norwegian North Atl. Exped., 1899, p. 79.
Sertularia pumila Nutting, Hydroids of the Woods Hole Region, 1901, p. 359.
Sertularia pumila Hargitt, American Naturalist, 1901, p. 389.
Sertularia pumila Whiteaves, Catalogue Marine Invert. Eastern Canada, 1901, p. 25.
Sertularia pumila Sæmundsson, Islandske Hydroider, 1902, p. 63.

Trophosome.—Colonies growing in tufts from a creeping root stalk, attaining a height of about 2 inches, stem not fascicled, straight, divided into regular internodes, each of which bears a pair of hydrothecæ, or a pair of hydrothecæ and a pair of branches; every third internode usually bearing branches, each pair of hydrothecæ and their internode forming a triangle.

Branches strictly opposite, springing from the hydrothecal bases, themselves sometimes branched unsymmetrically, divided into regular internodes each bearing a pair of hydrothecæ. Hydrothecæ strictly opposite, moderately distant, tubular, regularly curved, not adnate to each other in front, strictly lateral in position, nearly the distal half free, margin with two opposite teeth, and a two-flapped operculum; aperture oval.

Gonosome.—Gonangia borne on the front of the stem and branches, ovoid, with a very narrow collar and broad aperture. When mature the gonangia are often surmounted by globular acrocysts.

Distribution.—Almost throughout the Northern Hemisphere: Vineyard Sound (Verrill); Straits of Belle Isle (Packard); Nova Scotia (Dawson); coast of California (Clarke); Greenland (Fabricius); White Sea (Mereschkowsky); Iceland (Sæmundsson); Denmark (Winther); Norway (Sars); Helgoland (Hartlaub); British coasts (Hincks); Belgium (Van Beneden); Naples, New Zealand (Coughtrey).

This is one of the longest known and most widely distributed of the Sertularidæ, and has been the subject of much investigation. Perhaps the most notable study of the species is that given by the older Agassiz in his Contributions to the Natural History of the United States, where will be found some superbly beautiful illustrations of the species, particularly its reproductive parts. (Plate XXXII.)

SERTULARIA VERSLUYSI, new name.

(Plate I, figs. 4–9.)

Desmoscyphus gracilis ALLMAN, Challenger Report, Hydroids, Pt. 2, 1888, p. 71.
Desmoscyphus inflatus VERSLUYS, Hydraires de la Mer des Antilles, 1899, p. 42.

Trophosome.—Colony growing from a creeping stolon and attaining a height of about 2 inches, but many specimens are not more than one-half inch high. Stem not fascicled, sinuous, divided into regular internodes, each of which bears a branch and two hydrothecæ on one side and a single hydrotheca on the other; nodes oblique. Branches strictly alternate and regular, undivided, projecting at nearly a right angle from the stem, and divided by straight nodes into regular internodes. Hydrothecæ widely separated laterally on the stem, where they are alternate; strictly opposite on the branches, where the pairs are distant, being separated by about twice the height of the hydrothecæ and borne on the front of the branch. The individual hydrothecæ are short and stout, each contiguous with its fellow for nearly its entire height, the free distal ends having a horizontal upper outline and narrowing rapidly to a small bilobed dorso-ventrally compressed margin. In some specimens the hydrothecæ are much more robust, each pair, with its internode, making a triangular figure, as in fig. 9. Versluys believes that he found an operculum with a single flap attached to the abcauline side of the margin. My own specimens appear to show two flaps, but the opercula are badly ruptured and can not be interpreted with safety.

Gonosome.—Not known.

Distribution.—Off Bermuda, depth 30 fathoms (*Challenger*); Cape Verde Islands, 25 meters, (Versluys); found on floating gulf weed (*Albatross*).

An examination of Allman's type of *Desmoscyphus gracilis* shows that it agrees very exactly with the excellent description given by Versluys of his *D. inflatus*, the hydrothecæ on the stem being strictly alternate as in Plate I, fig. 4, of the present work, and not opposite as figured by Allman, Plate XXXIV, fig. 2.

M. Versluys was unavoidably misled by an incorrect drawing. The species is here placed in the genus *Sertularia* and, as the name *Sertularia gracilis* is preoccupied, I take pleasure in giving to this form the name of the first author who described and figured it correctly.

Type in the South Kensington Museum, London. A fragment in possession of the author.

SERTULARIA CHALLENGERI, new name.

(Plate II, figs. 1–2.)

Desmoscyphus pectinatus ALLMAN, Challenger Report, The Hydroids, Pt. 2, 1888, p. 71.

Trophosome.—Colony attaining a height of about 2 inches. Stem thick, not fascicled, slightly sinuous, divided into regular internodes, each of which bears, in the portion of the type examined by me, two alternate branches and six hydrothecæ. Branches alternate, springing from short processes of the stem, from which they are divided by two internodes, including a short nonhydrothecate internode; thick, divided into irregular internodes with a tendency to a regular arrangement of two hydrothecæ to each. Hydrothecæ strictly opposite, borne on the front of the branches, but seldom contingent, tubular, not noticeably swollen below, the distal portion bending gently outward and ending in a bilabiate margin, and a two-valved operculum.

Gonosome.—Unknown.

Distribution.—Off Bahia (Allman); off Moncœur Island, Bass Strait, 38–40 fathoms (Allman).

The above description is based on a portion of Allman's type kindly sent me by the South Kensington Museum. The character that seems most marked is the nonhydrothecate internode at the base of each branch. The portion of the specimen examined also had the peculiarity of having two alternate branches to each internode. The species is a typical *Sertularia* in the sense used in this work. The name *Sertularia pectinata* being preoccupied,[1] I herewith substitute that of the famous vessel by which the type was collected.

Type.—In the South Kensington Museum, London. Fragment in possession of the author.

SERTULARIA OPERCULATA Linnaeus.

(Plate II, figs. 3–5.)

Sea hair ELLIS, Essay Nat. Hist. Corallines, 1755, p. 8.
Sertularia operculata LINNÆUS, Systema Naturæ, 1758, p. 808.
Sertularia operculata HOUTTUYN, Natuurlyke Historie, XVII, 1761–1773, p. 531.
Sertularia usneoides PALLAS, Elenchus Zoophytorum, 1766, p. 132.
Sertularia operculata LINNÆUS, Systema Naturæ, 1767, p. 1307.
Sertularia usneoides BODDAERT, in Pallas, Lyst der Plant-Dieren, 1768, p. 164.
Sertularia coperculata MARATTI, De Plantis Zoophytis, etc., 1776, p. 26.
Sertularia usneoides GRONOVIUS, Zoophylacium Gronovianum, III, 1781, p. 357.
Sertularia operculata ELLIS and SOLANDER, Nat. Hist. Zoophytes, 1786, p. 39.
Sertularia usneoides WILKINS and HERBST, in Pallas, Charakteristik der Thierpflanzen, 1787, p. 170.
Sertularia operculata GMELIN, in Linnæus, Systema Naturæ, 13th ed., 1788–1793, p. 3844.
Dynamena operculata ESPER, Die Pflanzenthiere in Abbildung., III, 1788–1830, p. 191.
Sertularia operculata BERKENHOUT, Synopsis Nat. Hist. Great Britain, I, 1789, p. 216.
Sertularia operculata SHAW, Vivarium Naturae, etc., 1789–1813, pl. MVI.
Sertularia operculata ESPER, Fortsetzungen der Pflanzenthieren, II, 1794–1806, pl. IV.
Sertularia operculata BOSC, Hist. Nat. des Vers, III, 1802, p. 92.
Sertularia operculata TURTON, British Fauna, 1807, p. 212.
Sertularia operculata JAMESON, Catalogue of Animals of the Class Vermes, 1811, p. 564.
Dynamena (Sertularia) operculata LAMOUROUX, Nouv. Bullet. des Sc. par la Soc. philomatique, 1812, p. 184.
Nigellastrum usneoides OKEN, Lehrbuch der Naturgeschichte, Pt. 3, 1815, p. 93.
Sertularia operculata LAMARCK, Hist. Nat. des Anim. sans Vert., II, 1816, p. 118.
Dynamena operculata LAMOUROUX, Hist. des Polypiers, 1816, p. 176.
Sertularia operculata STEWART, Elements Nat. Hist. Animal King., II, 1817, p. 441.
Sertularia operculata SCHWEIGGER, Handbuch der Naturgeschichte, etc., 1820, p. 427.
Dynamena operculata LAMOUROUX, Exposition Méthodique, 1821, p. 12.
Dynamena operculata FLEMING, British Animals, 1828, p. 544.
Sertularia operculata LAMARCK, Hist. Nat. des Anim. sans Vert., 1836, p. 144.
Sertularia operculata MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 464.
Dynamena operculata JOHNSTON, Hist. Brit. Zooph., 1842, p. 77.
Sertularia operculata ALDER, Cat. Zooph. Northumb., 1857, p. 26.
Amphisbetia operculata AGASSIZ, L., Cont. Nat. Hist. U. S., IV, 1862, p. 355.
Dynamena operculata KIRCHENPAUER, Neue Sertulariden, 1863, p. 8.
Dynamena fasciculata KIRCHENPAUER, Neue Sertulariden, 1863, p. 12.

[1] Lamarck, Histoire Naturelle des Animaux sans Vertèbres, 1816, p. 140.

Sertularia operculata HINCKS, Brit. Hydroid Zooph., 1868, p. 263.
Sertularia operculata McINTOSH, Ann. and Mag., 4th ser., XIII, 1874, p. 213.
? *Sertularia operculata* THOMPSON, Ann. and Mag., 5th ser., III, 1879, p. 106.
Sertularia operculata WINTHER, Fortignelse de i Danmark Hydr., 1880, p. 266.
Sertularia operculata BALE, Journ. Microscopic Society, Victoria, 1881, p. 34.
Sertularia operculata BALE, Cat. Australian Hydroid Zooph., 1884, p. 67.
Sertularia operculata VON LENDENFELD, Australian Hydromedusæ, 1884, p. 622.
Sertularia operculata ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 61.
Sertularia operculata CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularia operculata BONNEVIE, Norwegian North Atl. Exped., 1899, p. 79.

Trophosome.—Colonies growing in tufts of very slender, delicate stems, sometimes attaining a height of 8 to 10 inches. Stem simple, straight, translucent, divided into more or less regular internodes, each of which normally bears a pair of hydrothecæ. Branches distant, alternate, themselves profusely branched in a dichotomous manner and tending toward an erect posture; internodes like those of the stem. Hydrothecæ rather distant, strictly opposite, leaning forward, tubular, the abcauline side nearly straight, the adcauline side immersed except its distal third; aperture large, beveled so as to face upward and slightly inward. Margin with two large abcauline teeth, one of which is much longer than the other and continued to a slightly curved sharp point. Operculum very delicate, of two parts, one of which is much larger than the other.

Gonosome.—Gonangia borne on stem and branches, long, ovate, with large distal aperture and operculum, and no neck. Walls perfectly smooth externally.

Distribution.—Almost world-wide, except on the coasts of the United States. Arctic Atlantic (Bonnevie); Denmark (Winther); British coasts (Hincks); Belgium (Van Beneden); near Azores, 450 fathoms (Allman); Africa (Busk); Australia (Bale); New Zealand (Thompson); *Albatross* Station 2770, lat. S. 48° 37′, long. W. 65° 46′, 58 fathoms; *Albatross* Station 2772, lat. S. 52° 16′, long. W. 68° 13′, 31.5 fathoms; *Albatross* Station 2773, lat. S. 52° 23′, long. W. 68° 11′, 10 fathoms; *Albatross* Station 2775, Straits of Magellan, 29.5 fathoms; *Albatross* Station 2777, Straits of Magellan, 19.75 fathoms.

The distribution of this beautiful sertularian is quite unusual, reaching from the Arctic Ocean to the Straits of Magellan. As yet it has not been reported from the coasts of the United States.

SERTULARIA PULCHELLA (d'Orbigny).

(Plate II, figs. 6–7.)

Dynamena pulchella D'ORBIGNY, Voyage dans l'Amérique méridionale, 1846, p. 26.
Sertularia furcata TRASK, Proc. Calif. Acad., March, 1857, p. 112.
Sertularia furcata AGASSIZ, North American Acalephæ, 1865, p. 145.
Sertularia furcata CLARK, Hydroids of the Pacific Coast, 1876, p. 258.
Sertularia furcata TORREY, Hydroida of the Pacific Coast, 1902, p. 66.

Trophosome.—Stem short, unbranched, rooted by a creeping stolon, simple, spreading in every direction forming dense verticillated clusters around the pieces of fucus on which it is usually found, attached to the stolon by a short, slender, twisted process about the length of an internode, divided by transverse joints into short regular internodes each bearing a single pair of hydrothecæ; color corneous. Hydrothecæ opposite, deeply immersed in the stem, with the two large, short teeth on the outer margin and a large aperture generally reaching to the stem. (Clark.)

Gonosome.—Gonothecæ large, sessile, generally borne near the base of the stem, though occasionally found scattered over the entire length, of an elongated oval form, sometimes slightly compressed, with a large, circular, terminal aperture. (Clark.)

Distribution.—Bay of San Francisco and Farallone Islands (Trask); Santa Cruz, Bay of Monterey, San Diego, Santa Barbara (Clark); San Pedro, Coronados Islands (Torrey). Shore to 24 fathoms. Patagonia (d'Orbigny).

I have not seen this species, and the above description is copied entire from that of Clark, who was the first one to give a complete description, including gonosome.[1] The beautiful figures

[1] Torrey claims to be the first to describe the gonosome of the *S. furcata*, when, curiously enough, the paper of Clark's which he cites gives both a clear description and a good figure of both trophosome and gonosome.

given by d'Orbigny make it practically certain that his species was identical with the one described long afterwards as *Sertularia furcata* by Trask and universally accepted by later writers under the latter name. This species differs from *S. operculata* in having the two conspicuous hydrothecal teeth of the same size. On the other hand, *S. pulchella* is closely allied to *S. bispinosa* Gray, from which it differs in having no spines to the gonangium.

SERTULARIA BISPINOSA (Gray).

(Plate II, figs. 8–11.)

Dynamena bispinosa Gray, Dieffenbach, Travels in New Zealand, 1842.
Dynamena bispinosa Hutton, Trans. New Zealand Inst., V, 1872.
Sertularia bispinosa Coughtrey, Trans. New Zealand Inst., VII, 1875, p. 284.
Sertularia bispinosa Coughtrey, Ann. and Mag., 4th ser., XVII, 1876, p. 27.
Sertularia bispinosa von Lendenfeld, Australian Hydromedusæ, Pt. 3, 1883, p. 407.
Sertularia bispinosa Bale, Catalogue Australian Hydroid Zoophytes, 1884, p. 68.
Diphasia symmetrica Von Lendenfeld, Australian Hydromedusæ, Pt. 3, 1884, p. 414.
Sertularia bispinosa Von Lendenfeld, Australian Hydromedusæ, Pt. 5, 1884, p. 622.
Diphasia symmetrica Von Lendenfeld, Australian Hydromedusæ, Pt. 5, 1884, p. 623.

Trophosome.—Colony attained a height of 6 to 8 inches (Bale). Stem not fascicled, bearing hydrothecæ throughout, internodes irregular, nodes distant, branches irregularly alternate, themselves branching dichotomously, internodes as in stem, a hydrotheca in the axil of each branch. Hydrothecæ strictly opposite, not leaning forward, well separated in front, tubular, but somewhat flask-shaped, adnate to the stem or branch by one-half the adcauline side, distal end narrowing to a moderately large aperture, margin with two abcauline teeth. Operculum not evident in specimens examined. Entire periderm thick and heavy, giving a rigid aspect to the colony.

Gonosome.—Gonangia large, obovate, with two flattened spines, one projecting from each shoulder; aperture large, with narrow collar or neck.

Distribution.—East Coast of South America, *Albatross* Station 2771, lat. S. 51° 34′, long. W. 68 , 50.5 fathoms. New Zealand (Hutton); Australia (Bale); "Trod. Hav.," (specimen from Levinsen.)

The above description is taken from a specimen from Professor Levinsen and labeled "*S. bispinosa* Gray, Trod. Hav.," which agrees quite exactly with the description given by Bale, and the specimen dredged by the U. S. Fish Commission steamer *Albatross* off the east coast of South America. This species seems much more rigid in habit than *S. operculata*, and the difference in the hydrothecal armature is reinforced by the conspicuous flattened spines on the gonangia.

SERTULARIA DESMOIDES Torrey.

(Plate III, figs. 1–3.)

Sertularia desmoides Torrey, Hydroida of Pacific Coast, 1902, p. 65.

Trophosome.—Colony very straggling and irregular in growth, arising from a creeping rootstalk and attaining a height of about 2 inches. Stem very long and slender, divided into irregular internodes, each of which bears one or more pairs of hydrothecæ, branches exceedingly irregular in their disposition, sometimes being very distant and forming a right angle with the stem and at others forming an irregular tuft at the distal end, internodes variable, sometimes absent from the greater part of a branch, and at others being divided by fairly constant joints placed a short distance below the hydrothecæ. Hydrothecæ strictly opposite, pairs usually quite distant but sometimes only moderately so, contingent in front for less than half their length, the distal portion curving outward and ending in an apparently round or oval aperture, facing outward and a little downward; no marginal teeth as a rule, but at times the margin has two obscure teeth. Operculum usually of one flap attached to the abcauline side, others with two ill-defined flaps, and again there will be two flaps, one above another, both attached to the abcauline side.

Gonosome.—"Gonothecæ borne on stem; sessile, ovate with a wavy outline and broad round aperture; half as broad as long. Single gonophore centrally placed, with cœnosarcal processes connecting it on all sides with gonothecal walls." (Torrey.)

Distribution.—San Diego, San Clemente Island, San Pedro, California, 1–42 fathoms (Torrey). *Albatross* Station 2939, lat. N. 33° 36′, long. W. 118° 09′ 30″, 27 fathoms.

Type.—In the collection of the University of California.

SERTULARIA RATHBUNI, new name.

(Plate III, figs. 4–9.)

Thuiaria sertularioides Allman,[1] Memoirs Mus. Comp. Zool., II, 1877, p. 28.
Desmoscyphus dalmasi Versluys, Hydraires Calyptoblastes recueillis dans la Mer des Antilles, 1899, p. 38.

Trophosome.—Colony consisting of main stem and irregularly disposed rigid branches, attaining a height of three inches. (Allman.) Stem without nodes on distal portion, with irregularly disposed nodes on proximal portion where the internodes are long and tend to bear each a single pair of hydrothecae. Hydrothecæ strictly opposite, roughly tubular, narrowing somewhat at both ends, contingent in front for about half their height, separated behind, ending in a margin with two large lateral and one small superior tooth, the latter inconspicuous and easily overlooked. Operculum with three flaps or valves.

Gonosome.—Not known.

Distribution.—Gulf of Mexico (Allman); Dry Tortugas, 45 m. (Versluys). *Albatross* Station 2389, lat. N. 29° 28′, long. W. 87° 56′; depth, 27 fathoms.

It seems to me to be altogether likely that Allman has figured the posterior aspect of this species, which will account for the separation of the pairs of hydrothecæ as shown in his figures. The figure given by Versluys[2] and that drawn by me agree with Allman's figures. The three teeth of the hydrothecæ might easily be mistaken for two, unless special care were taken. They are unmistakably present, however, in my specimens.

Type in the Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARIA GRACILIS Hincks.

(Plate III, fig. 10.)

Sertularia pumila var. B. Johnston, British Zoophytes, 1848, p. 469.
Sertularia gracilis Hassall, MSS. (according to Hincks).
Sertularia gracilis Hincks, British Hydroid Zoophytes, 1868, p. 262.
Sertularia gracilis Verrill, Am. Journ. Sci. and Arts, X, 1875, p. 43.
Sertularia gracilis Marktanner-Turneretscher, Hydr. des k. k. Hofmuseums, 1890, p. 240.
Sertularia gracilis Pictet and Bedot, Rés. Camp. Sc. Hirondelle, XVIII, 1900, p. 23.

Trophosome.—Colony small, rarely attaining a height of $\frac{1}{2}$ inch. Stem not fascicled, slender, often unbranched, divided into long and irregular internodes. Branches irregular, often wanting, and like the stem in all particulars. Hydrothecæ strictly opposite, pairs distant, the members of a pair contiguous in front and with their distal half free and regularly curved outward; margin with two opposite teeth and a two-flapped operculum.

Gonosome.—Gonangia borne on front of stem, large, obovate, with a wide neck and narrow but distinct collar, and evident operculum.

Distribution.—Naushon, Coast of Massachusetts (specimen in U. S. National Museum); Shetland (Norman); St. Malo (v. Marenzeller).

This species was formerly confounded with *S. pumila*, but is much more slender and delicate, with more distant hydrothecæ.

[1] In changing the genus of this species to *Sertularia* the name would become *Sertularia sertularioides*, a name preoccupied by Bale, Catalogue of the Australian Hydroid Zoophytes, 1884.

[2] Hydraires Calyptoblastes recueillis dans la Mer des Antilles, 1899, p. 39, fig. 8.

SERTULARIA CORNICINA (McCready).

(Plate IV, figs. 1–5.)

Dynamena cornicina McCready, Gymnophthalmata of Charleston Harbor, 1858, p. 204.
Dynamena cornicina A. Agassiz, North American Acalephæ, 1865, p. 142.
Sertularia cornicina Verrill, Invert. Vineyard Sound, 1871–72, p. 733.
Sertularia cornicina Verrill, Amer. Journ. Sci. and Arts, III, 1872, p. 437.
Sertularia complexa Clarke, Bull. Mus. Comp. Zool., X, 1879, p. 245.
Sertularia complexa Bale, Proc. Linn. Soc. New South Wales, III, 2d Ser, 1888, p. 769.
Sertularia cornicina Nutting, Hydroids of the Woods Hole Region, 1901, p. 359.
Sertularia complexa Nutting, Hydroids of the Woods Hole Region, 1901, p. 360.
Sertularia cornicina Hargitt, Amer. Nat., 1901, p. 390.

Trophosome.—Colonies growing in the form of erect unbranched stems, often bearing closely associated colonies of a parasitic campanularian, *Hebella calcarata*, and growing from a creeping root stalk, and attaining a height of about one-half inch. Stem delicate, straight, with a pinched place near its base, divided into regular internodes, each of which bears a pair of hydrothecæ. Hydrothecæ tubular, strictly opposite, rather distant, adnate in front for about two-thirds their length, the free distal portions being bent rather abruptly outward; margin with two broad opposite teeth; operculum of two flaps. The height of the hydrothecæ is usually about equal to that portion of an internode that lies between the hydrothecal base and the node below. There are usually four chitinous points extending downward into the cavity of the stem from the bottom of each hydrotheca. Hydranths of the usual sertularian type, capable of protruding far beyond the hydrothecal margin, as in fig. 1.

Gonosome.—Gonangia borne singly or in pairs at the base of the stem, subglobular in form, with a narrow round collar and large aperture, sides beautifully and regularly annulated.

Distribution.—Charleston Harbor (McCready); Woods Hole, Massachusetts (Nutting); Pourtales Plateau (Nutting); Yucatan coast, attached to an alga (Clarke); Australia (Bale).

This beautiful species has a curious distribution, being reported only from the widely separated regions noted above. There seems to be little doubt that Bale rightly identified his Australian specimens, and he also was the first to describe the profusely annulated gonangia, a type rarely seen in this genus.

The Woods Hole specimens were found first by Mr. Walmsley, and, like those originally described by Clarke, were always found growing on algæ. I am unable after careful study to separate the *S. complexa*, Clarke, from the present species, although I did so in a former work.[1] The characters there given are found to intergrade upon the examination of more material. The fact that the form called *S. cornicina* in that work always bore the parasitic *Hebella calcarata*, while the gonangia were always found associated with the *S. complexa* of that work, even at the same time of year, would render the identity of the two species doubtful. In the absence of any good morphological character, however, it seems best to combine them, although I do so with considerable hesitation.

Type.—Destroyed by fire in Charleston during the Civil War.

SERTULARIA MAYERI, new species.

(Plate V, figs. 1–4.)

Trophosome.—Colony unbranched, springing from a creeping root stalk, and attaining a height of about one-half inch. Stem constricted basally and divided into regular long internodes, each of which bears a pair of opposite hydrothecæ on its anterior side and tapers slightly at each end. Hydrothecæ with their bases a little below the middle of the internodes and contiguous for about half their adcauline sides. The distal hydrothecæ and those in a young colony are larger in their basal half and gradually narrow to a tubular distal portion which points outward and upward, ending in a three-toothed margin and appressed aperture. Operculum very delicate, apparently of two flaps. The proximal hydrothecæ are tubular, but little larger basally and bent abruptly

[1] Hydroids of the Woods Hole Region, 1901, p. 360.

outward at about their middle, so that their distal half is at right angles with their basal half and ends in a delicate collapsible tube, the margin and operculum of which is so thin that no constant form can be discerned. Entire colony excessively thin and delicate.

Gonosome.—Not known.

Distribution.—Shallow water between Eleuthera and Little Cat Islands, Bahamas; on floating seaweed, Great Bahama Banks (Bahama Expedition from the State University of Iowa); *Albatross* Station, 2369, Gulf of Mexico, 26 fathoms; *Albatross* Station, 2617, lat. N. 33° 37′ 30″, long. W. 77° 36′ 30″, 14 fathoms; off Cape Romanes (Moser).

Type slides.—Cat. Nos. 18661, 18663, Mus. State Univ. Iowa; Cat. Nos. U.S.N.M. 18719, 18720; also in the collection of the author.

SERTULARIA POURTALESI, new name.

(Plate V, fig. 5.)

Sertularia distans[1] ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 25.
Dynamena distans CLARKE, Bull. Mus. Comp. Zool., V, No. 10, 1879, p. 246.
Sertularia distans MARKTANNER-TURNERETSCHER, Hydr. des k. k. naturhist. Hofmuseums, 1890, p. 239.

Trophosome.—Colony unbranched or with a few irregularly disposed branches, attaining a height of 1¼ inches. Stem divided into long, irregular internodes, each of which bears one or more pairs of opposite hydrothecæ, the pair being on the distal half of the internode when but one pair is on that internode. Branches, when present, projecting from the stem in an exceedingly stiff and ungraceful manner. Hydrothecæ longer than in most of the closely allied species, distant, tubular, contingent in front for a varying portion of their length, the distal portion being curved gently outward and ending in a margin which is very thin and ill-defined in texture, but bears two teeth and an operculum of two flaps.

Gonosome.—Not known.

Distribution.—*Albatross* Station 2369, lat. N. 29° 16′ 30″, long. W. 85° 32′, 26 fathoms; Station 2315, lat. N. 24° 26′, long. W. 81° 48′ 15″, 37 fathoms; Station 2409, lat. N. 27° 04′, long. W. 83° 21′ 15″, 26 fathoms; Station 2465, lat. N. 45° 35′, long. W. 55° 01′, 67 fathoms; off Tennessee Reef, depth 2 fathoms (Allman); near Tortugas, 36 fathoms (Clarke); Sargassa Sea, on *Fucus* (Marktanner-Turneretscher); Pourtales Plateau (Bahama Expedition from the State University of Iowa).

The specimens from the Pourtales Plateau on which this description was based were compared directly with the type in the Museum of Comparative Zoology and found to agree. It belongs to the *Desmoscyphus* group, Allman's drawing having evidently been made from the posterior aspect of the colony. The hydrothecæ vary considerably in shape.

Type.—In Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARIA STOOKEYI, new species.

(Plate V, figs. 6–7.)

Trophosome.—Colony consisting of unbranched stems springing from a creeping root-stalk and attaining a height of about one-third inch. Stems constricted basally and divided into regular internodes, except proximal portion where the nodes become indistinct or obsolete; internodes long and slender, the hydrothecæ being placed in front of the distal half, the nodes being just above the hydrothecæ. Hydrothecæ strictly opposite, adnâte to each other by about the basal one-third of their adcauline wall, the line of juncture being straight; basal portion not distinctly swollen, distal one-half free, a slender cone in shape projecting at an angle of about 45 degrees with the stem, and ending in a bidentate margin and two-flapped operculum.

Gonosome.—Gonangia borne at bases of colonies, large, oval, with a straight narrow collar, wide narrow aperture, and operculum; pedicel very short.

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[1] This name was preoccupied by Lamouroux, Histoire des Polypiers coralligènes flexibles, vulgairement nommés Zoophytes, 1816, p. 191, for a campanularian, and was used later by Lamarck, Historie naturelle des Animaux sans vertèbres, 2d.edition, 1836, p. 151.

Distribution.—Found on floating seaweed on the Great Bahama Banks (Bahama Expedition from the State University of Iowa).

This species is more delicate, and the hydrothecæ are more slender than in other species of this group. I take pleasure in naming it after Professor Stookey, member of the Bahama Expedition.

Type slides.—Cat. Nos. 18665, 18666, Mus. State Univ. Iowa; Cat. Nos. 19710, 19711, U.S.N.M.; also in collection of the author.

SERTULARIA BREVICYATHUS Versluys.

(Plate VI, figs. 1–2.)

Desmoscyphus brevicyathus VERSLUYS, Hydraires Calyptoblastes recueillis dans la Mer des Antilles, 1899, p. 40.

Trophosome.—Colony consisting of an unbranched stem springing from a creeping root-stalk. Stem divided into regular long internodes, each bearing a pair of hydrothecæ on its distal half, and being enlarged at the middle to form a base of support for the hydrothecæ, the proximal and distal portion of each internode being narrowed. Hydrothecæ strictly opposite, turgid below, the inner outline being nearly a semicircle, the two of a pair being contiguous in the front of the stem on account of the extent to which they embrace the latter, but they are not placed in front as in typical species of the *Desmoscyphus* group; distal portion directed outward and narrowing rapidly to the three-toothed margin; operculum two-flapped.

Gonosome.—Not known.

Distribution.—Between Eleuthera and Little Cat islands, and near Spanish Wells, Bahamas (Bahama Expedition from the State University of Iowa); Cape Verde Islands, 25 meters (Versluys).

The specimen above described was collected by the Bahama Expedition from the University of Iowa. The hydrothecæ are somewhat more slender distally than indicated by Versluys's figures, but some individuals agree with them exactly.

Type.—In the collection of Comte R. de Dalmas.

SERTULARIA FLOWERSI, new species.

(Plate VI, figs. 3–4.)

Trophosome.—Colony minute, consisting of a very slender unbranched stem, attaining a height of about one-fourth of an inch. Stem divided into long, slender internodes by nodes placed immediately above the hydrotheca. Hydrothecæ very small, in strictly opposite pairs, which are situated on the distal ends of the internodes, distant, placed on the sides of the stem which they embrace, so as to be contiguous in front for about half their height; margin tridentate with a two-valved operculum. Inconspicuous chitinous processes extend downward from the bottoms of the hydrothecæ, as in *S. cornicina*.

Gonosome.—Not known.

Distribution.—Dredged near Habana, Cuba, from a depth of about 150 fathoms. Collected by the Bahama Expedition from the State University of Iowa.

This is the most slender and delicate species of *Sertularia* that the writer has seen. Named in honor of Capt. Charles B. Flowers, of the Bahama Expedition.

Type.—In the Museum of Natural History, State University of Iowa.

SERTULARIA TUMIDA Allman.

(Plate VI, fig. 5.)

Sertularia tumida, ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 23.

"*Trophosome.*—Hydrocaulus attaining a height of three-fourths of an inch, simple, internodes of moderate length, thinning away for some distance below each pair of hydrothecæ. Hydrothecæ opposite, short, tumid below, adnate to the stem for about half their length, and with the distal half free and diverging at nearly a right angle."

Gonosome.—Not known.

Distribution.—Tortugas, shallow water (Allman).

I have not seen this species and quote the original description entire. It is quite possible that the species is identical with *Sertularia brevicyathus*, which was collected by Versluys at the same place, but this point cannot be determined except by a comparison of the two types.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARIA EXIGUA Allman.

(Plate VI, fig. 6.)

Sertularia exigua ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 24.

"*Trophosome.*—Hydrocaulus minute, simple, attaining a height of about one-fourth of an inch; internodes very short, not prolonged by an attenuated continuation below the pairs of hydrothecæ. Hydrothecæ opposite, not tumid below; free and divergent on their distal half, and with the opposed sides of each pair parallel to one another."

Gonosome.—Not known.

Distribution.—Off Cape Fear, 9 fathoms (Allman).

I have not seen this species and have copied the original description entire.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

THUIARIA Fleming (modified).

Trophosome.—Hydrothecæ normally subopposite to alternate, and more than two to each internode. Internodes vary greatly in length. Hydrothecæ with smooth margin, or with one or two teeth, usually more or less immersed in the hydrocaulus. Operculum of one abcauline flap, or of two flaps.

Gonosome.—Gonangia oval, with large terminal aperture, unornamented or with one or two spines on the shoulders.

As before intimated, this genus as established by Fleming (1828) was very much restricted, containing but two species, and based solely on the immersed condition of the hydrothecæ. There was no change made by either Johnston (1848) or Hincks (1868).

In his diagnoses of new genera and species of hydroids Allman[1] adopted a new criterion for the genus, holding that the best character was based on the division of the hydrocaulus into internodes, there being an internode to each pair of hydrothecæ in *Sertularia*, *Sertularella* and *Diphasia*, "while in *Thuiaria* the joints occur at distant and, for the most part, irregular intervals, thus leaving numerous hydrothecæ to be carried on each internode." He was thus led to admit such species as *Sertularia argentea* and *S. cupressina* into the genus, as is done in the present work. In his report on the hydroida of the Challenger Expedition (1888) Allman maintains this same position.

In his Catalogue of Australian Hydroid Zoophytes (1884) Bale gives a further criterion. His definition of *Thuiaria* is "Zoophyte plant-like—Hydrothecæ biserial, not in pairs, usually more or less immersed." He points out the distinction between the hydrothecæ being in two series and being in pairs. This, however, often seems to depend on the thickness of the hydrocaulus. If it is very thick there are two series, while it often happens that on the more slender distal branches the hydrothecæ are regularly subopposite or alternate, or in pairs, as Bale uses the term.

Levinsen in his Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, p. 193, defines the genus as follows: "Apertura hydrothecæ rotundata (ovalis vel semicircularis). 'Collare' et 'dentibus' nullis instructa. In margine exteriore (abcaulini) valvula opercularis affixa est." Like the other genera founded on the characters of the margin and operculum, this one includes forms that the present writer and others regard as generically distinct, as *Selaginopsis alternitheca* Levinsen, and excludes others that are very closely related, as *Thuiaria dalli* or *T. robusta* Clark or *T. thuiarioides* Clark, the latter being a typical thuiarian, but with an adcauline operculum. Moreover in some cases certain parts of a colony would belong to *Thuiaria*, and others not, were the definition of Levinsen adhered to, as *T. robusta*, in which part of the

[1] Journal of the Linnæan Society, Zoology, XII, 1874, p. 267.

hydrothecæ have two teeth and a two-flapped operculum and part no tooth and a single-flapped operculum.

The genus, as I have defined it, is confessedly the least natural and satisfactory of those admitted in this work.

POINTS OF INTERGRADATION BETWEEN THUIARIA AND OTHER GENERA.

First. With *Sertularia*, in having the hydrothecal margin with two teeth and a two-flapped operculum, as in *T. argentea*, *T. similis*, *T. tenera*, *T. fabricii*, and *T. cupressina*. In all of these cases there are many hydrothecæ to an internode, and they are not strictly opposite.

Second. With *Abietinaria* in having an adcauline operculum, as in *T. thuiarioides* Clark. In every other respect, both in trophosome and in gonosome, this species is a typical *Thuiaria*.

KEY TO AMERICAN SPECIES OF THUIARIA.

Hydrothecal margins smooth, except on distal ends of branches, where they are bidentate. Operculum of one abcauline flap.[1]

Branches springing from all sides of stem.

Colony in the form of a stiff "bottle brush" .... *thuja*.

Colony not so stiff and rigid.

Hydrothecæ alternate.

Margin produced on outer side into prominent recurved hooks .... *elegans*.

Margin smooth, except on distal parts of branches, where there are two strong teeth .... *robusta*.

Hydrothecæ sub-opposite, margin smooth, operculum adcauline .... *thuiarioides*.

Branches alternate.

Hydrothecæ opposite.

Aperture round, facing directly outward .... *polycarpa*.

Aperture facing outward and upward, margin produced into a prominent lobe on adcauline side and appressed to stem .... *kurilæ*.

Hydrothecæ alternate.

Hydrothecæ entirely immersed, aperture strictly vertical .... *immersa*.

Distal end of hydrothecæ free, aperture facing outward and upward .... *lonchitis*.

Hydrothecal margin toothed, operculum with two flaps.

Hydrothecæ strictly alternate.

Branches opposite .... *plumulifera*.

Branches not opposite.

Margin with two large pointed teeth.

Entire adcauline hydrothecal wall adnate .... *ramosissima*.

Distal half of adcauline wall free .... *diffusa*.

Hydrothecæ sub-opposite, marginal teeth two, opposite.

No hydrothecæ on stem .... *dalli*.

Hydrotheca on stem.

Hydrothecæ flask-shaped, their long axes not parallel with stem.

Hydrothecæ with unequal teeth .... *latiuscula*.

Hydrothecæ with equal teeth .... *similis*.

Hydrothecæ tubular, their long axes parallel with stem .... *tubuliformis*.

Hydrothecæ sub-opposite, one or two marginal teeth.

Branches alternate, and usually undivided, hydrothecæ not immersed .... *tenera*.

Branches in a spiral, usually divided dichotomously.

Spiral close, colony forming a dense tuft .... *fabricii*.

Spiral loose, hydrothecæ not greatly immersed .... *argentea*.

Spiral loose, hydrothecæ extensively immersed, their axes not parallel with stem .... *cupressina*.

Spiral loose, hydrothecæ extensively immersed, their axes parallel with stem .... *plumosa*.

THUIARIA THUJA (Linnæus).

(Plate VII, figs. 1–3.)

Bottle-brush Coralline Ellis, Essay Nat. Hist. Corallines, 1755, p. 10.
Sertularia thuja Linnæus, Systema Naturæ, 1758, p. 809.
Sertularia thuja Houttuyn, Natuurlyke Historie, 1761–1773, p. 543.
Sertularia thuja Pallas, Elenchus Zoophytorum, 1766, p. 140.
Sertularia thuja Linnæus, Systema Naturæ, 12th ed., 1767, p. 1308.

[1] Except in the case of *T. thuiarioides* Clark.

Sertularia thuja BODDAERT, in Pallas, Lyst der Plant-Dieren, 1768, p. 175.
Sertularia thuja MARATTI, De Plantis Zoophytis et Lithophytis, 1776, p. 29.
Sertularia thuja FABRICIUS, Fauna Grœnlandica, 1780, p. 444.
Sertularia thuja GRONOVIUS, Zoophylacium gronovianum, III, 1781, p. 358.
Sertularia thuja ELLIS and SOLANDER, Nat. Hist. Zoophytes, 1786, p. 41.
Sertularia thuja WILKINS and HERBST, in Pallas, Charakteristik der Thierpflanzen, 1787, p. 179.
Sertularia thuja GMELIN, Systema Naturæ, Linnæus, 13th ed., 1788–1793, p. 3848.
Sertularia thuja ESPER, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 184.
Sertularia thuja BERKENHOUT, Synop. Nat. Hist., Great Britain, I, 1789, p. 217.
Sertularia thuya ESPER, Fortsetzungen der Pflanzenthiere, II, 1794–1806, pl. XXII.
Sertularia thuja CUVIER, Tableau Elémentaire de l'Hist. Nat. des Anim., 1798, p. 666.
Sertularia thuja BOSC, Hist. Nat. des Vers, III, 1802, p. 94.
Sertularia thuja TURTON, British Fauna, 1807, p. 213.
Sertularia thuya JAMESON, Catalogue Animals of Class Vermes, 1811, p. 564.
Nigellastrum (*Sertularia*) *thuja* OKEN, Lehrbuch der Naturgeschichte, 1815, p. 93.
Cellaria thuja LAMARCK, Hist. Nat. des Anim. sans Vert., 1816, p. 139.
Sertularia thuja LAMOUROUX, Hist. des Polyp. Coral. Flex., 1816, p. 195.
Sertularia thuja STEWART, Elements nat. hist. animal King., 2d ed., II, 1817, p. 442.
Thuiaria thuia FLEMING, British Animals, 1828, p. 545.
Thuiaria thuia MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 464.
Thuiaria thuia JOHNSTON, Hist. Brit. Zoophytes, 1847, p. 83.
Thuiaria thuja GRAY, List of British Animals, 1847, p. 76.
Thuiaria thuia ALDER, Cat. Zooph. Northumb., 1857, p. 27.
Thuiaria thuja A. AGASSIZ, North Amer. Acalephæ, 1865, p. 148.
Thuiaria thuja HINCKS, British Hydroid Zoophytes, 1868, p. 275.
Thuiaria thuja SCHULZE, Nordsee Expedition, 1872, p. 133.
Thuiaria thuia SARS, G. O., Bidrag til Kundskaben om Norges Hydroider, 1873, p. 18.
Thuiaria thuja MCINTOSH, Ann. and Mag., 4th ser., XIII, 1874, p. 214.
Thuiaria thuja MERESCHKOWSKY, Ann. and Mag., 5th ser., I, 1878, p. 324.
Thuiaria thuia WINTHER, Fortignelse de i Danmark, etc., 1880, p. 251.
Thuiaria thuia KIRCHENPAUER, Nordische Gattungen und Arten, 1884, p. 18.
Thuiaria thuja MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 237.
Thuiaria thuja DRIESCH, Tektonische Studien, 1890, p. 207.
Thuiaria thuja LEVINSEN, Meduser, Ctenophorer og Hydroider, 1892, p. 52.
Thujaria thuja LEVINSEN, Vid. Udb. "Hauchs" Togter, 1893, p. 371.
Thuiaria thuia CRAWFORD, Ann. and Mag., 6th Ser., XVI, 1895, p. 261.
Thuiaria thuja BONNEVIE, Norwegian North Atlantic Expedition, 1899, p. 83.
Thuiaria thuja HARGITT, American Naturalist, 1901, p. 392.
Thuiaria thuja NUTTING, Hydroids of the Woods Hole Region, 1901, p. 364.
Thuiaria thuja WHITEAVES, Catalogue Marine Invert. eastern Canada, 1901, p. 26.
Thujaria thuja SÆMUNDSSON, Bidrag til kundsk. islandske Hydroider, 1902, p. 65.

Trophosome.—Colony sometimes attaining a height of a foot or more. Main stem geniculate, rigid, slender, divided proximally into obscure internodes, each of which bears the stump of a branch. Branches arranged in a spiral around the stem, from which they project at nearly a right angle, dichotomously branching several times so that each forms a flabellate structure with the upper side concave. Conjointly the branches and branchlets form a typical "bottle-brush" structure. Hydrothecæ subalternate, closely approximated, almost entirely immersed in the hydrocaulus; aperture a flattened oval without conspicuous teeth and opening vertically. Operculum a single abcauline flap.

Gonosome.—Gonangia borne on the upper sides of the branches, oblong ovate with a round aperture, short but distinct collar, and no lateral spines.

Distribution.—One of the common species in comparatively shallow water on both sides of the North Atlantic. New England coast (Nutting); Mingan Islands (A. Agassiz); Bering Straits (Stimpson); Gulf of St. Lawrence (Whiteaves); Greenland (Levinsen); Iceland (Sæmundsson); Norway (Sars); British coasts (Hincks); Mediterranean (Pallas); *Albatross* Station 2256, lat. N. 40° 38′ 30″, long. W. 69° 29′, 30 fathoms; *Albatross* Station 2843, lat. N. 53° 56′, long. W. 165° 56′ 45″, 45 fathoms; *Albatross* Station 3558, lat. N. 56° 58′, long. W. 170° 09′, 25 fathoms.

This is one of the oldest and best known of the Sertularidæ, and one of the very few that have not been bandied about between genera for the last half century. It has a peculiarly rigid habit that is characteristic of no other hydroid.

THUIARIA ELEGANS Kirchenpauer.

(Plate VII, fig. 4.)

Thuiaria elegans KIRCHENPAUER, Nordische Gattungen und Arten, 1884, p. 21.

Trophosome.—Colony attaining the height of about 4½ inches. Stem slender, slightly flexuose with irregularly disposed deep annular nodes, beset on all sides with the stumps of broken branches. Branches inserted on all sides of stem, flexuose, divided by deep nodes into long internodes. Hydrothecæ alternate, oval, entirely immersed; aperture obliquely cut so as to form two angles to the otherwise horizontal margin, the outer angle or projection being much larger than the inner (adcauline), so much so that it (the outer tooth) forms a backward directed horn.

Gonosome.—Unknown.

Distribution.—Plover Bay, Bering Sea (Krause).

I have not seen this species, and have taken the above description from the original by Kirchenpauer, the translation being modified to accord with the plan of description followed in this work.

Type.—In the Leipsic Museum?

THUIARIA ROBUSTA Clark.

(Plate VIII, figs. 5–7.)

Thuiaria robusta CLARK, Proc. Acad. Nat. Sci., Philadelphia, 1876, p. 227.
Thuiaria robusta KIRCHENPAUER, Nordische Gattungen und Arten, 1884, p. 81.

Trophosome.—Colony consisting of a simple stem attaining a height of about 12 inches in the largest specimen examined. Stem strong, flexuose, bearing stumps of spirally arranged branches throughout about three-fourths of its length, the upper portion bearing large branches which bear branchlets arranged in a spiral so that the distal part of a colony assumes the shape of a dense brush or tuft. The main stem and branches give off a branch to each internode, while the hydrocladial internodes are of varying length, each usually bearing a number of subalternate, thickly approximated hydrothecæ. Hydrothecæ long, tubular, slightly swollen below, immersed to the aperture on larger branches, but with distal one-third exserted on distal part of branchlets; aperture bilabiate, operculum with two flaps on distal portions of branches, often with round margin and single abcauline flap on proximal portions. At the base of each hydrotheca is a thickening of the perisarc described by Clark as a double-pointed pyramid (see fig. 5).

Gonosome.—Gonangia borne in rows on the terminal branchlets, slender, with a terminal collar and aperture, and two long curved spines rising from the antero-lateral corners of the shoulders.

Distribution.—Sea Horse Islands and Cape Prince of Wales, Arctic Ocean; Hagmeister Island, and 12 miles east of Kings Island, Bering Sea (Clark). Arctic cruise of Corwin, 1885. *Albatross* Station 2875, lat. N. 48° 30′, long. W. 124° 57′, 40 fathoms; Station 3153, lat. N. 37° 57′ 10″, long. W. 122° 56′ 20″, 32 fathoms; Station 3504, lat. N. 56° 57′, long. W. 169° 27′, 34 fathoms; Station 3505, lat. N. 57° 09′, long. W. 168° 17′, 44 fathoms; Station 3511, lat. N. 57° 32′, long. W. 169° 38′, 39 fathoms; Station 3515, lat. N. 59° 59′, long. W. 167° 53′, 13 fathoms; Station 3540, lat. N. 56° 27′, long. W. 166° 08′, 51 fathoms.

This species is not nearly so rigid as *T. thujá*, and the gonosome is entirely different.

Type.—In the collection of the U. S. National Museum.

THUIARIA THUIARIOIDES (Clark).

(Plate VIII, figs. 1–6.)

Sertularia thuiarioides CLARK, Alaskan Hydroids, 1876, p. 223.
Thuiaria thuiaroides CALKINS, Some Hydroids from Puget Sound, 1899, p. 361.
Thuiaria thujarioides HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 354.
Thuiaria thuiarioides NUTTING, Hydroids of the Harriman Expedition, 1901, p. 186.

Trophosome.—Colony attaining a height of about 7½ inches. Main stem irregularly branched, the branches being inserted in a spiral owing to the twisting of the stem; internodes

long and irregular, sometimes bearing two hydrothecæ and a branch on one side and a single hydrotheca on the other. Main branches like the stem, bearing alternate branchlets that often divide dichotomously, divided into long and irregular internodes each bearing two lateral rows of hydrothecæ.

Hydrothecæ subopposite, tubular, expanded below, narrowing above into a very short neck ending in a circular aperture which faces upward and slightly toward the branch. Operculum of one adcauline valve.

Gonosome.—Gonangia borne on upper sides of branchlets, ovate, flattened, expanded laterally and distally into two flat spines set on the shoulder. Aperture terminal, round, borne on a short neck resembling the frustum of a cone.

Distribution.—Bering Sea, west of Nunivak Island, 24 fathoms; Chignik Bay, Alaska (Clark); Puget Sound (Calkins); Yakutat, Alaska (Nutting). Lat. N. 62° 15′, long. W. 167° 48′, Lieut. George N. Stoney, U. S. Navy.

This is a very well-marked species of a typical thuiarian character, except in its operculum. The opercula are well shown in some of the specimens collected by Dr. W. H. Dall.

Type.—In the collection of the U. S. National Museum.

THUIARIA POLYCARPA Kirchenpauer.

(Plate VIII, figs. 7–9.)

Thuiaria polycarpa Pœppig (Manuscript), Kirchenpauer, Nordische Gattungen und Arten, 1884, p. 27.

Trophosome.—Colony (fragmentary) about 1 inch in height. Stem straight with very uneven internodes and two opposite rows of hydrothecæ, branches irregularly alternate, rigid, divided into long and uneven internodes, each bearing several pairs of hydrothecæ. Hydrothecæ in strictly opposite pairs, long, tubular, with distal ends bent outward, aperture round, facing directly outward, the top of one hydrotheca not reaching the base of the next one above, the pairs being slightly but definitely separated.

Gonosome.—Unknown.

Locality.—Valparaiso, Chile (Pœppig).

The above description is from a specimen kindly sent me by Professor Levinsen. This species differs from most of the genus *Thuiaria* in having exactly opposite hydrothecæ. The other characters are so strictly thuiarian, however, that there seems little doubt regarding the propriety of including it in the genus.

Type.—In the Leipsic Museum.

THUIARIA KURILÆ (Pœppig).

(Plate IX, figs. 1–2.)

Sertularia kurilæ Pœppig (Manuscript)?

Trophosome.—Specimen about 3 inches high. Stem unbranched, divided into very long and irregular internodes and bearing a row of hydrothecæ on each side, there being three hydrothecæ, one axillary and two others, between adjacent branches. Branches strictly alternate and divided into long and irregular internodes by distant nodes. Hydrothecæ subopposite, flask-shaped, the distal end but little constricted. Aperture large, opening outward and a little upward, margin with a very large tooth or lobe rising upward on the adcauline side and closely appressed to the hydrocaulus. This tooth is apparently broken off in many cases.

Gonosome.—Not present in the specimen described.

Locality.—Unalaska.

The specimen above described was received from Prof. G. M. R. Levinsen. I have not seen the original description and am unable to cite it. Coming from so high an authority I have felt justified in including it here. The very large lobe or tooth on the adcauline side of the hydrotheca is a character that divides this species from all other American members of the genus.

THUIARIA IMMERSA, new species.

(Plate IX, figs. 3–4.)

Thuiaria lonchitis Marktanner-Turneretscher, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 236.
Thuiaria lonchitis Marktanner-Turneretscher, Hydroiden Ost Spitzbergen, 1895, p. 422.

Trophosome.—Colony (incomplete) less than 1 inch high. Stem irregularly but deeply annulated throughout the thick proximal portion which bears no branches and which appears to have been broken off and renewed, the new portion bearing all the branches. Distal part of stem feebly geniculate, without evident nodes, bearing alternate lateral branches, one to each geniculation, and two rows of hydrothecæ. Hydrothecæ alternate, slender, flask-shaped, much smaller distally, the apertures opening vertically and not projecting at all from the general surface of the hydrocaulus. Just under the lower edge of the margin is a thickening of the hydrothecal wall that is plainly evident in a side view. The aperture is perfectly smooth and round, without teeth. There is a well-marked space between the top of one hydrotheca and the bottom of the next. Texture of colony corneous, much stiffer and stronger than in *T. lonchitis.*

Gonosome.—Not known.

Distribution.—Coast of Greenland, U. S. S. *Alert*, 1884; Austro-Hungarian Polar Expedition, lat. N. 76° 14′, long. E. 85° 54′. (Marktanner-Turneretscher.)

This species seems to me to be certainly distinct from *T. lonchitis* of authors, which is a much larger and more graceful species, with hydrothecæ projecting perceptibly from the stem and branches, and opening obliquely upward and outward. The specimen collected by the U. S. S. *Alert* agrees exactly with the figure and description given by Marktanner-Turneretscher under the name *Thuiaria lonchitis.*

He calls attention to the main differences between this specimen and the typical *lonchitis*, but apparently did not regard these differences of sufficient import to warrant a separation, an opinion with which I am unable to agree.

It is possible that other writers have had this species in hand and described it either as *T. articulata* or *T. lonchitis.*

Type.—In the U. S. National Museum. Fragment in collection of the author.

THUIARIA LONCHITIS (Ellis and Solander).

(Plate IX, figs. 5–8.)

Sea-Spleenwort or Polypody Ellis, Essay Nat. Hist. Corallines, 1755, p. 42.
Sertularia lonchitis Ellis and Solander, Nat. Hist. Zoophytes, 1786, p. 42.
Sertularia lonchitis Bosc, Hist. Nat. des Vers, 1802, p. 101.
Sertularia lichenastrum Turton, British Fauna, 1807, p. 216.
? *Nigellastrum* (*Sertularia*) *articulata* Oken, Lehrbuch der Naturgeschichte, 1815, p. 93.
Cellaria lonchitis Lamarck, Hist. Nat. Anim. sans Vert., 1816, p. 139.
Thuiaria articulata Fleming, British Animals, 1828, p. 545.
Thuiaria articulata Hassall, Ann. and Mag., VII, 1841, p. 284.
Thuiaria articulata Hyndman, Ann. and Mag., X, 1842, p. 20.
Thuiaria articulata Gray, Brit. Animals, 1847, p. 76.
Thuiaria articulata Johnston, Hist. Brit. Zooph., 1847, p. 84.
? *Thuiaria articulata* Alder, Cat. Zooph. Northumb., 1857, p. 27.
? *Thuiaria articulata* Hincks, British Hydroid Zoophytes, 1868, p. 277.
Thuiaria articulata Whiteaves, Ann. and Mag., 4th ser., X, 1873, p. 345.
Thuiaria articulata Schulze, Nordsee Exped., 1874, p. 133.
? *Thuiaria articulata* Mereschkowsky, Ann. and Mag., 5th ser., I, 1878, p. 324.
Thuiaria articulata Verrill, Prelim. Check-list, 1879, p. 18.
? *Thuiaria articulata* D'Urban, Zool. Barent's Sea, 1880, p. 269.
Thuiaria lonchitis Kirchenpauer, Nordische Gattungen und Arten, 1884, p. 22.
? *Thuiaria articulata* Bergh, Goplepolyper fra Kara Havet, 1887, p. 337.
Thuiaria articulata Bourne, Hydroids of Plymouth, 1889–90, p. 397.
Thujaria lonchitis Levinsen, Vid. Udb. "Hauchs" Togter, 1893, p. 371.
Thuiaria articulata Crawford, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
? *Thuiaria articulata* Bonnevie, North Atlantic Expedition, 1899, p. 83.
Thuiaria articulata Pictet and Bedot, Hydraires de l'Hirondelle, 1900, p. 25.
Thuiaria articulata Whiteaves, Cat. Marine Invert. Eastern Canada, 1901, p. 27.
Thujaria lonchitis Sæmundsson, Bidrag til Kundskaben islandske Hydroider, 1902, p. 65.

Trophosome.—Colony attaining a height of 10 to 12 inches, usually much less, main stem with very distinct but irregular nodes below, slightly flexuose, bearing usually a pair of subalternate hydrothecæ on each of the upper internodes. Branches irregularly alternate, simple, or dichotomously branched, forming a rather dense tuft on distal part of colony. Branches and branchlets divided into long and irregular internodes each of which bears several pairs of subopposite to subalternate hydrothecæ. Hydrothecæ of the usual thuiarian type, deeply immersed in proximal parts of branches and less so in distal parts, closely approximated. Aperture circular to subtriangular, facing forward or outward, margin often with a single broad tooth on its posterior side. Operculum of a single abcauline flap.

Gonosome.—Gonangia borne on upper side of branches, long, slender, with a round aperture, narrow collar, and operculum.

Distribution.—Common on British and Continental shores of North Atlantic; New England Coast (Verrill); "Atlantic coast" (specimen from the United States National Museum); Iceland (Sæmundsson); Gulf of St. Lawrence (Whiteaves); ? Barents Sea (D'Urban); Polar Sea (Bonnevie).

In the absence of the gonosome this species is not always easy to distinguish from *T. cupressina*. The habit of growth, however, is entirely different from the graceful spiral arrangement which characterizes the latter. Branches stiffer and harsher. The gonosome is entirely different. The species appears to be rare on our Atlantic coast.

The synonymy of this species is exceedingly uncertain on account of a mistake of Pallas[1] who gave the name *Sertularia articulata* to an Atlantic species under the mistaken impression that it was identical with the "Sea-Spleenwort" of Ellis. Afterwards Fleming (1842) instituted the genus *Thuiaria*, and, apparently misled by Pallas, called the Spleenwort of Ellis *Thuiaria articulata*. In the meantime Ellis and Solander (1758) gave the name *Sertularia lonchitis* to Ellis's species of Sea-Spleenwort, thus securing the priority for the name *lonchitis*, which is essentially a northern form. Since that time most writers have confused the two species under the common name *Thuiaria articulata*. Hincks in his great work (1868) seems to have done this. In 1884 Kirchenpauer clearly explained the situation and reestablished the name *T. lonchitis* for Ellis's species, in which he was followed by Levinsen (1893). In most cases it is impossible to tell which species is meant when the name *T. articulata* is used, and we can only judge from the distribution.

THUIARIA PLUMULIFERA Allman.

(Plate IX, figs. 9–13.)

Thuiaria plumulifera ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 27.
Thuiaria plumulifera KIRCHENPAUER, Nordische Gattungen und Arten, 1884, p. 25.

Trophosome.—Colony attaining a height of 10 inches in the largest specimen examined. Main stem exceedingly long and slender, divided into internodes of unequal length, bearing rather distant and opposite branches each of which bears an axillary hydrotheca; an additional hydrotheca being between each two branches on each side. Branches rather distant, alternate, divided into long and very unequal internodes, and contracted at their origins. Hydrothecæ alternate, well separated, tubular, not extensively immersed for this genus; aperture with two broad, rounded teeth and a tubular collapsible extension of the hydrothecal walls. This tube is not constant, and in some hydrothecæ where it is wanting a two-valved operculum is seen.

Gonosome.—Not known.

Distribution.—Off Cape Fear, 7 fathoms (Allman); *Albatross* Station 2015, lat. N. 37° 31′, long. W. 74° 53′ 30″, 19 fathoms; Station 2260, lat. N. 40° 13′ 15″, long. W. 69° 29′ 15″, 46 fathoms; Station 2265, lat. N. 37° 07′ 40″, long. W. 74° 35′ 40″, 70 fathoms; Station 2279, lat. N. 35° 20′ 55″, long. W. 75° 20′ 55″, 16 fathoms; Station 2307, lat. N. 35° 42′, long. W. 74° 54′ 30″, 57.3 fathoms; Station 2308, lat. N. 35° 43′, long. W. 74° 53′ 30″, 45 fathoms; Station 2421, lat. N. 37° 07′, long. W. 74° 34′ 30″, 64 fathoms.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

[1] Elenchus Zoophytorum, 1766, p. 1371.

This species is squarely intermediate between the genera *Thuiaria* and *Sertularella*, having the characters of numerous hydrothecæ to the internode, and the two-toothed margin and two-valved operculum of the former, and the exactly alternate hydrothecæ of the latter. I place it provisionally in the latter genus, as it seems here to find, on the whole, its closest affinities, although it agrees quite well with *Sertularella nana* Hartlaub, so far as the nonspecific characters are concerned.

? THUIARIA RAMOSISSIMA Allman.

Thuiaria ramosissima ALLMAN, Gatty Coll., 1885, p. 146.

"*Trophosome.*—Hydrocaulus monosyphonic, main stem sending off in every direction branches which are themselves profusely branched; ramifications subdichotomous, each bifurcation preceded by a transverse joint. Hydrothecæ alternate, adnate to the hydrocaulus by the whole of their epicauline walls, deep, tubular; the apocauline margin of aperture deeply cleft.

"*Gonosome.*—Gonangia springing each from a point placed laterally just below the base of a hydrotheca. None mature in the specimen.

"*Locality.*—Northeast coast of America."

I have not seen this species and have copied the above description entire. It resembles greatly the common *Thuiaria argentea*, but it does not seem likely that Professor Allman would have made a mistake regarding such a well-known form.

THUIARIA DIFFUSA (Allman).

(Plate X, figs. 1–3.)

Sertularella diffusa ALLMAN, Gatty Coll., 1885, p. 136.
Sertularia diffusa ALLMAN var. MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 229.

Trophosome.—Colony attaining a height of 9 inches (Allman), much branched, stiff, and corneous in aspect. Stem nearly straight, divided into long and irregular internodes, lower part without hydrothecæ. Branches straight, alternate, themselves dividing alternately and the branchlets ultimately dividing dichotomously, divided into usually long internodes of unequal length, the distal being generally the shorter. Hydrothecæ tubular, gracefully curved, ordinarily strictly alternate, about the distal half free and pointing forward and outward, margin with two large pointed lateral teeth, aperture crescent-shaped. Operculum not evident, the distal superior part of the hydrothecal wall being very thin and collapsible so that it seems to serve as an operculum.

Gonosome.—Gonangia borne on distal part of the branches, ovoid, with two lateral anterior spines and a narrow collar surrounding a broad, round aperture.

Distribution.—Rockaway (Atlantic coast, U. S. ?) (Allman). South America (Marktanner-Turneretscher); "South America," specimen from Levinsen; *Albatross* Station 2279, lat. N. 35° 20′ 55″, long. W. 75° 20′ 55″, 16 fathoms.

This species also is very near *Thuiaria argentea*, and the specimen described by Allman may belong to this species. Those described by Marktanner-Turneretscher, the one from Station 2279, and the specimen sent me by Professor Levinsen from South America seem to be specifically distinct. The whole texture is stiff and rigid and deeply corneous in color, differing greatly from *T. argentea.* The forming of a pseudo-operculum by the thin collapsible distal part of the inner (upper in position) hydrothecal wall is an interesting feature.

THUIARIA DALLI, new name.

(Plate X, figs. 4–6.)

Sertularia cupressoides CLARK, Alaskan Hydroids, 1876, p. 220.
Thuiaria cupressoides [1] NUTTING, Hydroids of the Harriman Expedition, 1901, p. 185.

Trophosome.—Colony small, in specimens examined, and plumose in form. Main stem straight, divided into usually short internodes by oblique nodes, many internodes bearing two

[1] Name preoccupied by Kirchenpauer, Nordische Gattungen und Arten, 1884, p. 18, for an entirely different species.

branches, others more, but an equal number on both sides, no hydrothecæ on main stem. Branches subopposite to alternate, ascending, constricted at their origins where they bear several deep annulations, divided into long but unequal internodes, each of which bears several hydrothecæ. Hydrothecæ subopposite, closely approximated, deeply immersed, their distal ends only being free, tubular, very slightly curved distally; aperture with two rather broad teeth; operculum composed of two flaps.

Gonosome.—Not known.

Distribution. Shumagin Islands and Port Moller, Alaska (Clark); Yakutat, Alaska (Nutting).

Type slides.—Cat. No. 19721, U.S.N.M.; Cat. Nos. 18676, 18677, State Univ. of Iowa; also in the collection of the author.

?THUIARIA LATIUSCULA (Stimpson).

Sertularia latiuscula STIMPSON, Marine Invert. Grand Manan, 1853, p. 8.
Sertularia latiuscula VERRILL, Proc. Am. Assn. Adv. Sci., 1873, p. 356.
Sertularia latiuscula VERRILL, Am. Journ. Sci. and Arts, VII, 1874, p. 39.
Sertularia latiuscula A. AGASSIZ, North American Acalephæ, 1865, p. 145.

"Pinnæ broad, compressed, attached by a slender base to the main stem; cells crowded, nearly opposite, shaped as in *Sertularia argentea;* vescicles elongated, ovate, with a single strong spine on one side at the extremity. Color, brownish. Breadth of pinna, 0.03 inch. Dredged in the laminarian zone."

Distribution.—Grand Manan (Stimpson); 6 miles east of Seguin Island, 33 fathoms (Verrill); between Cape Cod and Gulf of St. Lawrence (Verrill).

I have been unable to obtain an authentic specimen of this species. The above description is taken entire from that of the original describer. No further description nor any figure has thus far been found. There is no doubt that it is a *Thuiaria*, and it is quite probable that it is *T. argentea.* The single spine to the gonangium occurs occasionally in that species.

Type.—Apparently lost; at least, I cannot find where it is.

THUIARIA SIMILIS (Clark).

(Plate X, figs. 7–9.)

Sertularia similis CLARK, Alaskan Hydroids, 1876, p. 219.
?*Sertularia similis* HARTLAUB, Hydroiden aus dem Stillen Ocean, 1891, p. 354.
Sertularia similis NUTTING, Hydroids of the Harriman Expedition, 1901, p. 185.

Trophosome.—Colony usually consisting of a central stem, sometimes attaining a height of over 3 inches. Stem geniculate, divided into regular internodes, each of which bears a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches divided into usually short internodes, each of which bears from one to several pairs of opposite or subopposite hydrothecæ. Hydrothecæ in closely approximated pairs, the individuals of a pair being distinctly separated in front, and of the *Sertularia pumila* type, with free outwardly inclined distal portions; aperture with two well-marked and nearly opposite teeth and a two-valved operculum.

Gonosome.—Not known.

Distribution.—Hagmeister Island (Clark); Bare Island (Hartlaub); Berg Inlet, Glacier Bay (Harriman Expedition); Puget Sound (Nutting); *Albatross* Station 2842, lat. N. 54° 15′, long. W. 166° 03′, 72 fathoms; Station 2865, lat. N. 48° 12′, long. W. 122° 49′, 40 fathoms; Station 3465, lat. N. 48° 21′, long. W. 123° 14′, 48 fathoms; Station 3515, lat. N. 59° 59′, long. W. 167° 53′, 13 fathoms; Station 3557, lat. N. 57° 04′, long. W. 170° 24′, 26 fathoms.

The specimen from Station 3515, from which the above description was taken, agrees very well with Clark's original description and figure. Other specimens vary considerably, but not sufficiently to demand separation. Indeed, none of them vary as much from the type as the specimen figured by Hartlaub, which seems to me to be quite distinct.

Type.—In collection of the U. S. National Museum.

THUIARIA TUBULIFORMIS (Marktanner-Turneretscher)

(Plate XI, figs. 1–8.)

Dynamena tubuliformis MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 238.

Trophosome.—Colony growing in tufts of straight stems, reaching a height of about 3 inches. Stem straight and even throughout, divided into regular internodes, each of which bears a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches strictly alternate, divided into irregular internodes and much constricted at their origins. Hydrothecæ subopposite, long, tubular, with the greater part of their lateral outline parallel to the branch, the upper portion being abruptly bent outward and ending in two large opposite teeth and a two-valved operculum.

Gonosome.—Gonangia growing on front of stem, large, ovate, with a constricted curved neck and round terminal aperture.

Distribution.—Dschidda (Dr. Billitzer); Bay of Bahia, Brazil (Rathbun); Florida, between Salt Pond and Stock Island (Dr. E. Palmer); Bahama Banks, 3 to 6 fathoms (Nutting).

The gonosome of this species is figured here for the first time. There is a slight tendency for the hydrothecæ to arrange themselves in groups, reminding one of those found in the genus *Pasythea*, the upper ones in each group being somewhat smaller than the lower pair.

Type.—In the k. k. Hofmuseums, Vienna.

THUIARIA TENERA (Sars).

(Plate XI, figs. 9–12.)

Sertularia tenera SARS, Bidrag til Kundskaben om Norges Hydroider, 1873, p. 20.
Sertularia tenera HINCKS, Ann. and Mag., 4th ser., XIII, pp. 129 and 151.
Sertularia tenera WINTHER, Naturhist. Tidsskrift (3), XII, 1879–80, p. 246.
Sertularia tenera LEVINSEN, Vid. Udb. "Hauchs" Togter, 1893, p. 384.
Sertularia tenera MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 230.
Sertularia tenera LEVINSEN, Vid. Meddel. naturhist. Foren., 1892, p. 48.
Sertularia tenera MARKTANNER-TURNERETSCHER, Hydroiden von Öst Spitzbergen, 1893, p. 418.
Sertularia tenera NUTTING, Hydroids from Alaska and Puget Sound, 1899, p. 743.
Thuiaria tenera BONNEVIE, North Atlantic Expedition, 1899, p. 83.
Thuiaria tenera SÆMUNDSSON, Bidrag til Kundsk. islandske Hydroider, 1902, p. 62.

Trophosome.—Colony attaining a height of about 3 inches in largest specimens examined. Main stem straight proximally and slightly flexuose distally, divided into long and irregular internodes bearing strictly alternate branches and three hydrothecæ (one axillary and two not) between adjacent branches on each side. Branches usually undivided and with rather short internodes, which often bear a single pair of hydrothecæ. Hydrothecæ subalternate, flask-shaped, rather slender, widely separated, much exserted, with a tubular distal portion; margin varying greatly, sometimes being round and without teeth, and often being curved, with two teeth of regular sertularian type. In many cases the margin is produced into a thin collapsible tube. Operculum usually composed of one flap attached to abcauline side of margin, but sometimes composed of two flaps.

Gonosome.—Gonangia ovate, with a round terminal aperture and a short collar.

Distribution—Kodiak Island and Bering Straits (Dall); *Albatross* Station 2865, lat. N. 48° 12′, long. W. 122° 49′, 40 fathoms; St. Pauls Island (Nutting); Norway, 159 fathoms (Sars); Iceland (Hincks); Denmark (Winther); Christiania (Marktanner-Turneretscher); Spitzbergen (Marktanner-Turneretscher); North Atlantic (Bonnevie).

This species appears to break down the generic distinctions proposed by Levinsen in that it has both a one-flapped and a two-flapped operculum in the same specimen.

THUIARIA FABRICII (Levinsen.)

(Plate XII, figs. 1–2.)

Sertularia fastigiata FABRICIUS (not Linnæus), Fauna Grönlandica, 1780, p. 458.
Sertularia cupressina FABRICIUS, Manuscript, III, p. 388.
Sertularia argentea WINTHER, Naturhist. Tidsskrift (3), XII, 1879–80, p. 278.
Sertularia fabricii LEVINSEN, Vid. Middel. Naturh. Foren., 1892, p. 48.
Sertularia fabricii CALKINS, Hydroids from Puget Sound, 1899, p. 361.
Sertularia fabricii HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 354.
Thuiaria fabricii NUTTING, Hydroids of the Harriman Expedition, 1901, p. 185.

Trophosome.—Colony attaining a height of about 2 inches in the specimens examined. Main stem straight, proximal part marked by very deep irregularly spaced annular nodes; distal part divided into irregular internodes each bearing one or more branches which are inserted on all sides of the stem in a spiral manner so as to give the colony the shape of a bushy tuft. Branches very closely approximated, dichotomously divided once, twice, rarely three times; internodes rather long and irregular, each bearing several pairs of hydrothecæ, exceptionally a single pair. Hydrothecæ subopposite on proximal parts of branches and subalternate at tips of branches. Hydrothecæ flask-shaped, of the sertularian type, distal portions free, slightly out-curved, aperture narrow and furnished with two strong marginal teeth and a two-flapped operculum.

Gonosome.—Gonangia borne on upper sides of branches and branchlets, oblong oval in shape, very delicate in texture, with a terminal round aperture on a neck resembling the frustum of a cone, and two lateral spines which, however, are only exceptionally present in the specimens examined. An acrocyst is often present.

Distribution.—West coast of Greenland (Levinsen); Puget Sound (Calkins).[1] Dutch Harbor, Alaska, and Orca, Alaska (Nutting).

THUIARIA ARGENTEA (Linnæus).

(Plate XII, figs. 3–9.)

Squirrel's-tail, ELLIS, Nat. Hist. Corallines, 1755, p. 6.
Sertularia argentea LINNÆUS, Systema Naturæ, 1758, p. 809.
Sertularia cupressina (part) PALLAS, Elenchus Zoophytorum, 1766, p. 141.
Sertularia cupressina, var. *β. argentea*, LINNÆUS, Systema Naturæ, 1767, p. 1308.
Sertularia argentea MARATTI, De Plantis Zoophytis, 1776, p. 27.
Sertularia argentea, ELLIS and SOLANDER, Nat. Hist. of Zooph., 1786, p. 38.
Sertularia argentea GMELIN, in Linnæus, Systema Naturæ, 1788–1793, p. 3847.
Sertularia argentea ESPER, De Pflanzenthiere in Abbildungen, III, 1788–1830, p. 179.
Sertularia argentea BERKENHOUT, Synop. nat. hist. Great Britain and Ireland, I, 1789, p. 216.
Sertularia argentea BOSC, Nat. Hist. des Vers, III, 1802, p. 93.
Sertularia argentea TURTON, British Fauna, 1807, p. 213.
Sertularia argentea JAMESON, Catalogue of Animals of the Class Vermes, 1811, p. 564.
Sertularia argentea LAMOUROUX, Bullet. philomatique, 1812, p. 184.
Sertularia argentea LAMARCK, Hist. Nat. des anim. sans Vert., II, 1816, p. 117.
Sertularia argentea LAMOUROUX, Hist. des Polypiers Coralligènes, 1816, p. 192.
Sertularia argentea STEWART, Elements Nat. Hist. Animal Kingdom, II, 1817, p. 442.
Sertularia argentea BOSC, Hist. Nat. des Vers, 1830, p. 108.
Sertularia argentea DE BLAINVILLE, Manuel d'Actinologie, 1834, p. 480.
Sertularia argentea LAMARCK, Nat. Hist. Anim. sans Vert., 1836, p. 143.
Sertularia argentea HASSALL, Ann. and Mag., VI, 1841, p. 168.
Sertularia argentea MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 464.
Dynamena argentea FLEMING, British Animals, 1842, p. 544.
Sertularia argentea JOHNSTON, Hist. Brit. Zooph., 1847, p. 79.
Sertularia argentea DALYELL, Rare and Remarkable Animals of Scotland, I, 1847, p. 189.
Sertularia argentea GRAY, List Brit. Animals, 1847, p. 73.
Sertularia argentea GOSSE, Devonshire Coast, 1853, p. 434.
Sertularia argentea STIMPSON, Marine Invert. Grand Manan, 1854, p. 8.

[1] It appears that Doctor Calkins and I made a similar mistake in thinking that Levinsen regarded *S. fabricii* as the same as *S. argentea* of authors, instead of *S. argentea* of Winther. See references given above.

Sertularia argentea ALDER, Cat. Zooph. Northumb., 1857, p. 26.
Sertularia argentea A. AGASSIZ, North American Acalephæ, 1865, p. 144.
Sertularia argentea VAN BENEDEN, Fauna Littorale de Belgique, 1866, p. 184.
Sertularia argentea HINCKS, British Hydroid Zoophytes, 1868, p. 268.
Sertularia argentea VERRILL, Invert. Vineyard Sound, 1871–72, p. 732.
Sertularia argentea SCHULZE, Nordsee Exped., 1872, p. 132.
Sertularia argentea VERRILL, Proc. Am. Assn. Adv. Sci., 1873, pp. 256, 359, 364, 374.
Sertularia argentea McINTOSH, Ann. and Mag., 4th ser., XIII, 1874, p 213.
Sertularia argentea VERRILL, Amer. Journ. Sci., VII, 1874, p. 39.
Sertularia argentea VERRILL, Amer. Journ. Sci , VII, 1874, p. 133.
Sertularia argentea CLARK, Hydroids of Pacific Coast, 1876, p. 257.
Sertularia argentea, var. *divaricata* CLARK, Hydroids of New Eng. Coast, 1876, p. 64.
Sertularia argentea MERESCHKOWSKY, Ann. and Mag., 5th ser., I, 1878, p. 324.
Sertularia argentea WINTHER, Naturhist. Tidsskrift, 1880, p. 249.
?*Sertularia argentea* BERGH, Goplepolyper fra Kara Havet, 1887, p. 335.
Sertularia argentea BOURNE, Hydroids of Plymouth, 1889, p. 396.
Sertularia argentea DRIESCH, Tektonische Studien, 1890, p. 206.
Sertularia argentea MARKTANNER-TURNERETSCHER, Hydroiden des k. k. Naturhist. Hofmuseums, 1890, p. 232.
Sertularia argentea LEVINSEN, Vid. Udb., "Hauchs" Togter, 1893, p. 370.
Sertularia argentea CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Thuiaria argentea BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 83.
Thuiaria argentea NUTTING, Hydroids from Alaska and Puget Sound, 1899, p. 741.
Thuiaria argentea NUTTING, Hydroids of Woods Hole, 1901, p. 363.
Sertularia argentea HARGITT, Amer. Naturalist, 1901, p. 390.
Thuiaria argentea NUTTING, Hydroids of the Harriman Exped., 1901, p. 184.
Thuiaria argentea WHITEAVES, Cat. Marine Invert. Eastern Canada, 1901, p. 27.
Sertularia argentea SÆMUNDSSON, Bidrag til Kundskaben islandske Hydroider, 1902, p. 62.
Sertularia argentea TORREY, Hydroids of Pacific Coast, 1902, p. 67.

Trophosome.—Colony attaining a height of a foot or more, usually considerably less. Stems growing often in clusters, long, slender, divided by distant nodes into irregular internodes, with distant hydrothecæ. Branches rather distant, spirally arranged, each branch dividing dichotomously into an exceedingly delicate and graceful tracery of branchlets, the whole colony being among the most beautiful of the hydroids. The axil of each branch and branchlet is occupied by a hydrotheca. Internodes distant and irregular. Hydrothecæ subopposite to alternate, not greatly immersed, the terminal one-third often being free, bending gracefully outward, with a strongly bilabiate aperture, one tooth being usually much longer and more acute than the other. Operculum two-valved.

Gonosome.—Gonangia borne on upper sides of branches at bases of hydrothecæ, subtriangular in outline, being widened distally by two blunt lateral spines. Aperture terminal, collar very low, acrocysts borne on mature gonangia.

Distribution.—One of the commonest species in shallow water on both shores of the North Atlantic, Alaska, and the North Polar regions.

This is one of the best known of the Sertularidæ. It most nearly resembles *T. cupressina*, from which it differs in having a much more bushy habit, more exserted hydrothecæ with more conspicuous teeth. The gonangia are broader in proportion to their height, and the lateral spines are usually less conspicuous. The finest specimens I have seen came from Jerome Creek, Maryland.

THUIARIA CUPRESSINA (Linnæus).

(Plate XIII, figs. 1–3.)

Sea-cypress ELLIS, Essay Nat. Hist Corallines, 1755, p. 7.
Sertularia cupressina LINNÆUS, Systema Naturæ, 1758, p. 808.
Sertularia cupressina HOUTTUYN, Natuurlyke Historie, XVII, 1761–73, p. 537.
Sertularia cupressina (part) PALLAS, Elenchus Zoophytorum, 1766, p. 141.
Sertularia cupressina (part) LINNÆUS, Systema Naturæ, 1767, p. 1308.
Sertularia cupressina (part) BODDAERT, Lyst der Plant-Dieren, 1768, p. 176.
Sertularia cupressina MARATTI, De Plantis Zoophytis, 1776, p. 27.
Sertularia cupressina (part) GRONOVIUS, Zoophylacium gronovianum, 1781, p. 358.

Sertularia cupressina (part) ELLIS and SOLANDER, Nat. Hist. Zooph., 1786, p. 38.
Sertularia cupressina (part) WILKINS and HERBST, Charakteristik der Thierpflanzen, 1787, p. 180.
Sertularia cupressina (part) GMELIN, (Linnæus) Systema Naturæ, 1788–93, p. 3847.
Sertularia cupressina (part) ESPER, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 177.
Sertularia cupressina BERKENHOUT, Synop. nat. hist. Great Britain and Ireland, I, 1789, p. 216.
Sertularia cupressina (part) BOSC, Hist. Nat. des Vers, III, 1802, p. 93.
Sertularia cupressina TURTON, British Fauna, 1807, p. 213.
Sertularia cupressina JAMESON, Catalogue Animals Class Vermes, 1811, p. 564.
Sertularia cupressina LAMOUROUX, Bullet. philomatique, 1812, p. 184.
Nigellastrum cupressina OKEN, Lehrbuch der Naturgeschichte, 1815, p. 93.
Sertularia cupressina LAMARCK, Hist. Nat. des anim. sans Vert., II, 1816, p. 118.
Sertularia cupressina LAMOUROUX, Hist. des Polypiers, 1816, p. 192.
Sertularia cupressina STEWART, Elements Nat. Hist. Animal Kingdom, II, 1817, p. 442.
Sertularia cupressina BOSC, Hist. Nat. des Vers, 1830, p 108.
Sertularia cupressina de BLAINVILLE, Manuel d'Actinologie, 1834, p. 480.
Sertularia cupressina OKEN, Allgemeine naturgeschichte, 1835, p. 79.
Sertularia cupressina LAMARCK, Hist. nat. anim. sans vert., 1836, p. 144.
Sertularia cupressina HASSALL, Ann. and Mag., VI, 1841, p. 168.
Sertularia cupressina MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 464.
Dinamena cupressina FLEMING, British Animals, 1842, p. 544.
Sertularia cupressina JOHNSTON, Hist. British Zoophytes, 2d ed., 1847, p. 80.
Sertularia cupressina GRAY, List of British Animals, 1847, p. 74.
Sertularia cupressina ALDER, Cat. Zooph. Northumb., 1857, p. 26.
Sertularia cupressina A. AGASSIZ, North American Acalephæ, 1865, p. 143.
Sertularia cupressina VAN BENEDEN, Faune littorale de Belgique, 1866, p. 178.
Sertularia cupressina HINCKS, British Hydroid Zoophytes, 1868, p. 270.
Sertularia cupressina VERRILL, Invert. Vineyard Sound, 1871–2, pp. 408, 732.
Sertularia cupressina VERRILL, Proc. Am. Assn. Adv. Sci., 1873, pp. 353, 364.
Sertularia cupressina VERRILL, Amer. Journ. Sci. and Art, 3d ser., VII, 1874, pp. 44, 413, 504.
Sertularia cupressina McINTOSH, Ann. and Mag., 4th ser., XIII, 1874, p. 213.
Sertularia cupressina WINTHER, Om Internodiets, etc., 1879–80, p. 308.
Sertularia cupressina WINTHER, Naturhist. Tidsskrift, 1879–80, p. 248.
Sertularia cupressina D'URBAN, Zoology of Barents Sea, 1880, p. 269.
Thuiaria cupressina ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 67.
Sertularia cupressina BOURNE, Hydroids of Plymouth, 1889–90, p. 396.
Sertularia cupressina LEVINSEN, Vid Udb. "Hauchs" Togter, 1893, p. 370.
Sertularia cupressina HARTLAUB, Hydromedusen Helgolands, 1894, p. 451.
Sertularia cupressina CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularia cupressina MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1895, p. 233.
Thuiaria cupressina PICTET and BEDOT, Rés. Camp. Sc. Hirondelle, 1900, p. 24.
Thuiaria cupressina NUTTING, Hydroids of the Woods Hole Region, 1901, p. 364.
Sertularia cupressina HARGITT, American Naturalist, 1901, p. 390.
Thuiaria cupressina WHITEAVES, Cat. Marine Invert. Eastern Canada, 1901, p. 27.
Thuiaria cupressina SÆMUNDSSON, Bidrag til Kundskaben islandske Hydroider, 1902, p. 62.

Trophosome.—Colony sometimes attaining a height of a foot or more, usually much less. Main stem long, very slender, internodes not evident, a hydrotheca in the axil of each branch. Branches regularly alternate, dichotomously branching, with a tendency toward a spiral arrangement; internodes distant and irregularly spaced. Hydrothecæ subopposite to subalternate, deeply immersed, of the regular thuiarian pattern, with a rather large bilabiate aperture and a two-lobed operculum. The distal hydrothecæ are more exserted and alternate than the proximal, and in some cases are almost identical with those of *T. lonchitis*, on the one hand, and *T. argentea* on the other.

Gonosome.—Gonangia borne in rows on the upper sides of the branchlets, rather stout, flattened, with a terminal round aperture, distinct collar and operculum, and two very strong, sharply pointed, lateral spines projecting upward, one from each shoulder. An acrocyst is present when the gonophores are mature.

Distribution.—Common on European and New England shores of the North Atlantic, extending downward to a depth of about 150 fathoms; Denmark (Winther); Barents Sea, 160

fathoms (D'Urban); Iceland (Sæmundsson); Labrador (Packard); Mediterranean, Gulf of Gascony (Pictet and Bedot); Gulf of St. Lawrence (specimens from Sir William Dawson).

This is one of the oldest and best known of the Sertularidæ. The finest specimens that I have seen came from St. Georges Bank, Newfoundland.

THUIARIA PLUMOSA Clark.

Thuiaria plumosa Clark, Alaskan Hydroids, 1876, p. 228.
Thuiaria plumosa Kirchenpauer, Nordische Gattungen und Arten, 1884, p. 21.

"*Trophosome.*—Hydrocaulus simple, erect, very slender at the base, increasing in size to the distal end, somewhat twisted, jointed transversely, internodes of the proximal portion of very unequal length, some being three times the length of others, those of the upper portion are quite uniform, regularly branched; branches short, arranged alternately, one to each internode, but owing to the twist in the stem take on a spiral form, the uppermost erect, lying close to the stem, the lower ones curve outward, attached to the stem by a very prominent process, bearing a few branchlets, regularly jointed; branchlets do not extend beyond the ends of branches, and lie close to the latter. Hydrothecæ largest at the base, tapering slightly outward, entirely immersed; aperture toward the stem, the outer side produced, rim ornamented with two large teeth placed on the outer side, two tooth-like processes of the perisarc also occur in the base of each hydrotheca, arranged sub-alternately upon the branches and branchlets. Upon the stem there are three to each internode, two placed opposite to each other and one in the axil of the branch.

"*Gonosome.*—Gonangia sessile, very long and narrow, tapering gradually to the base, ornamented with two short horns placed on opposite sides of the orifice near the distal end; orifice terminal, large; borne in single rows on the upper side of the branches and branchlets. Height of largest specimen, 40 mm.

"*Habitat.*—Bering Sea, 5 miles southwest of the west cape of Nunivak Island; 30 fathoms, sand. Icy Cape, Arctic Ocean; 15 fathoms, sand."

I have not seen this species, and have copied entire the excellent description given by the original describer, Clark.

Type.—Should be in the collection of the U. S. National Museum, but I have been unable to find it there.

PASYTHEA Lamouroux (in part).

Trophosome.—Hydrothecæ biserial, strictly opposite, arranged in groups of pairs, a group to an internode, the upper pair being smaller and differing in shape from the lower; margin bilabiate, with a two-flapped operculum.

Gonosome.—Gonangia oval, smooth or with sides marked by broad annular rugosities, with a large aperture and narrow collar.

This genus was introduced by Lamouroux in 1812[1] to accommodate two unrelated species, one being the well-known *P. quadridentata* and the other the so-called *P. tulipier*, a bryozoan. It remained for Bale to give an adequate definition[2] which was adopted in 1890 by Marktanner-Turneretscher.[3] The group appears to be well defined, with evident relationship to *Sertularia* in several respects, such as the opposite position of the hydrothecæ and the characters of the hydrothecal margin and operculum. There are but three species known, I believe, one, *P. quadridentata* from both the Atlantic and Pacific, one, *P. hexodon*, from the Australian region, and a third, *P. philippina*, from the Philippines.

The American form is typical of the genus as defined above.

[1] Nouveau Bulletin des Sciences par la Société philomatique, III, Paris, 1812, p. 183.
[2] Australian Hydroid Zoophytes, 1884, p. 112.
[3] Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 234.

PASYTHEA QUADRIDENTATA (Ellis and Solander).

(Plate XIII, figs. 4–7.)

Sertularia quadridentata ELLIS and SOLANDER, Nat. Hist. Zooph., 1786, p. 57.
Sertularia quadridentata GMELIN, Systema Naturæ (Linnæus), 1788, p. 3853.
Pasythea quadridentata ESPER, Die Pflanzenthiere in Abbildungen, III, 1788, p. 237.
Sertularia quadridentata ESPER, Fortsetzungen der Pflanzenthieren, II, 1794, p. 32.
Sertularia quadridentata BOSC, Hist. nat. des Vers, III, 1802, p. 97.
Pasythea (Sertularia) quadridentata LAMOUROUX, Bulletin philomatique, 1812, p. 183.
Pasythea quadridentata LAMOUROUX, Hist. des Polypiers coralligènes, 1816, p. 156.
Sertularia quadridentata LAMARCK, Hist. nat. anim. sans vert., II, 1816, p. 121.
Pasythea quadridentata SCHWEIGGER, Handbuch der Naturgeschichte, 1820, p. 426.
Pasythea quadridentata LAMOUROUX, Exposition méthodique, 1821, p. 9.
Tuliparia quadridentata de BLAINVILLE, Manuel d'Actinologie, 1834-1837.
Pasythea quadridentata BALE, Australian Hydroid Zooph., 1884, p. 112.
Pasythea quadridentata von LENDENFELD, Australian Hydromedusæ, 1884, pp. 419, 624.
Pasythea quadridentata BALE, Proc. Linn. Soc. New South Wales, 2d ser., III, 1888, p. 770.
Pasythea quadridentata MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 234.
Pasythea quadridentata THORNELY, Hydroid Zoophytes collected by Doctor Willey, 1899, p. 456.

Trophosome.—Colony attaining a height of about one-third of an inch, consisting of a single unbranched stem growing from a creeping root-stalk, divided by oblique nodes into regular internodes, each of which bears a pair of hydrothecæ, or two or three pairs in a closely compressed group. Hydrothecæ on the first internode a single opposite pair, contingent for about half their height in front, somewhat swollen below, the distal part curving to a narrow, bidentate, or obscurely tridentate margin, and an operculum of two flaps. Sometimes the first internode bears two pairs of opposite hydrothecæ, the lower of which is like the pair just described, the other pair being wedged in between the diverging free portions of the lower hydrothecæ, the bases of the former being indented by the latter. Sometimes two or more internodes have this same arrangement of hydrothecæ. One or more of the distal internodes often have a group of three pairs of hydrothecæ, the lower two being as just described, the upper being wedged in between the second pair, so that they are widely separated, the upper pair being more erect, more extensively adnate to each other than the others; lowest pair largest, next smaller, and the upper pair smallest.

Gonosome.—A single gonangium is borne at the base of the stem, ovate in shape, with annular corrugations, a very broad, round aperture, no collar, and an operculum stretched across like a drumhead.

Distribution.—Coast of Africa, near the island of Ascension (Ellis and Solander); Fitzroy Island and Point Stevens, Australia (Haswell); Coogee, Bondi, Australia (Bale); Atlantic Ocean (Marktanner-Turneretscher); South Seas (Thornely); between Eleuthera and Little Cat Islands, British West Indies (Bahama Expedition, State University of Iowa).

This species seems to be always found growing on floating seaweed.

SERTULARELLA Gray (modified).

Trophosome.—Hydrothecæ biserial, strictly alternate, usually with three or four marginal teeth and a well-marked operculum with three or four flaps. Rarely the teeth are obliterated, in which case the operculum is stretched across the hydrothecal aperture like a drumhead. Branches never regularly anastomosing to form a reticulate, flabellate structure.

Gonosome. Gonangia usually ornamented with annular corrugations or ridges. Aperture at the end of a trumpet-shaped tube, or else encircled by a narrow, broad collar, and several blunt, spine-like projections.

This is perhaps the most satisfactory generic group of the Sertularidæ, because it is capable of more exact delimitation than the other genera, and is based on characters that are easily seen. As originally defined by Gray,[1] the genus contained but two species, *S. polyzonias* and *S. rugosa.*

[1] List of Specimens of British Animals, Radiata, London, 1847, p. 68.

Hincks (1868) described six, and Hartlaub (1900) includes eighty-six species, the largest number yet included in any one genus of the Hydroida. Allman adopted the genus in his earlier works,[1] but abandoned it in his Report on the Hydroida of the Challenger Expedition, 1888. Hincks, in his British Hydroid Zoophytes, 1868, and Bale, in his Catalogue of Australian Hydroid Zoophytes, 1884, called attention to the character of the operculum, now considered the best means of delimiting the genus, and in this they have been followed by nearly all subsequent writers of importance.[2]

In 1900 there appeared a work by Doctor Hartlaub which contains by far the most complete and masterly discussion that has ever been offered concerning any single genus of the order Hydroida.[3] The ground has thus been so completely covered by one fully equipped for the best work, with unusual advantages for examining a large number of types in the most important museums of Europe, that the present writer has found his labors greatly lightened so far as the genus *Sertularella* is concerned, and has availed himself freely and with confidence of the results of Doctor Hartlaub's labors, especially in the matter of bibliography and distribution of species of this great genus. In the few cases where Doctor Hartlaub has given references unavailable to myself I have taken them on his authority, having verified so great a majority that I am convinced of their entire reliability. This writer's definition of the genus is substantially the same as the one adopted in the present work. He does not claim to give a final definition, but simply employs it as a means of assembling all the forms that he regards as closely related to *Sertularella* as ordinarily understood. He finds that the characters of the internodes relied upon by Schneider[4] is very inconstant, and that Levinsen has relied too implicitly on the characters of the marginal teeth and operculum.[5] He does not regard the operculum of *Sertularella* as homologous with that of *Sertularia*, the former being a definite structure added above the real hydrothecal margin, while the latter is the thin end of the hydrothecal wall itself.

POINTS OF INTERGRADATION BETWEEN SERTULARELLA AND OTHER GENERA.

Although there are certain species that do not come strictly within the definition above given for *Sertularella*, there is only one that comes within the limits of any other genus as defined in this work, and that is *S. clarkii*, which bears considerable resemblance to certain species of *Thuiaria* in the aperture and marginal teeth. The strictly alternate hydrothecæ, however, and the regularity of the internodes are sufficient, in my opinion, to overbalance these thuiarian features and justify the inclusion of the species in *Sertularella*.

There are several species in which the gonosome differs from the typical *Sertularella* in not being annulated. *S. episcopus* has gonangia that are strongly ribbed longitudinally, reminding one of certain species of *Abietinaria*, such as *A. costata* Nutting; *S. turgida* (Trask) has gonangia that have the distal portion beset with strong spines, reminding one of these structures in some members of the genus *Diphasia*, such as *D. acanthocarpus* (Busk), and *S. formosa* Fewkes has a perfectly smooth gonangium resembling some of those found in the genus *Sertularia*. All of these species, however, come well within the genus and could not consistently be placed in any other.

The following key, like the others in this work, is purely artificial and makes no claim to indicate the relationship of the species involved.

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[1] Diagnoses of New Genera and Species of Hydroids, Journal of the Linnæan Society, 1874, p. 261; Memoirs of the Museum of Comparative Zoology, V. No. 2, 1877, p. 21; Description of Australian, Cape, and other Hydroids, mostly from the collection of Miss H. Gatty, Journal of the Linnæan Society, XIX, 1885, p. 133.

[2] See the General Systematic Discussion, p. 19.

[3] Revision der Sertularella-Arten, von Doctor Clemens Hartlaub, Hamburg, 1900.

[4] Hydroidpolypen von Rovigno, Kiel, 1897, p. 523.

[5] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 57.

KEY TO THE AMERICAN SPECIES OF THE GENUS SERTULARELLA.

- Hydrothecæ with four teeth.
  - Hydrothecal walls marked by annular rugosities.
    - Rugosities on upper side of hydrothecæ only.
      - Hydrothecæ large, stem fascicled .... *gayi*.
      - Stem not fascicled.
        - Hydrothecæ distinctly narrowed distally .... *conica*.
        - Hydrothecæ not distinctly narrowed distally .... *catena*.
    - Rugosities on all sides of hydrothecal walls.
      - No distinct neck to the hydrothecæ.
        - Hydrothecæ quadrate in cross section .... *quadrata*.
        - Hydrothecæ round in cross section.
          - Hydrothecæ very large .... *tanneri*.
        - Hydrothecæ not very large.
          - Hydrothecæ distant, rugosities not very deep .... *geniculata*.
          - Hydrothecæ approximated, rugosities very deep .... *patagonica*.
      - A distinct square neck to the hydrotheca.
        - Hydrothecæ largely immersed, closely approximated .... *rugosa*.
        - Hydrothecæ exserted, not closely approximated.
          - Hydrothecæ with two very distinct rugosities .... *areyi*.
          - Hydrothecæ with several less distinct rugosities .... *tenella*.
  - Hydrothecal walls smooth, without regular rugosities.
    - Marginal teeth distinctly of unequal size.
      - Hydrothecæ inclined forward .... *allmani*.
      - Hydrothecæ not inclined forward in noticeable degree .... *contorta*.
    - Marginal teeth of approximately equal size.
      - Entire adcauline wall adnate to hydrocaulus.
        - Hydrothecæ closely approximated.
          - Colony of very thin hyaline structure .... *lata*.
          - Colony of thick corneous structure .... *alba*.
        - Hydrothecæ distant, stem fascicled below .... *pinnigera*.
        - Hydrothecæ distant, stem not fascicled .... *distans*.
      - Practically the entire adcauline wall free .... *cylindritheca*.
      - Less than one-third of adcauline wall adnate.
        - Hydrothecæ enormous, margins reduplicated .... *gigantea*.
        - Hydrothecæ not extraordinarily large.
          - Hydrothecæ cylindrical .... *amphorifera*.
          - Hydrotheca smooth and its internode fusiform .... *fusiformis*.
          - Hydrothecæ rugose, pediculate .... *solitaria*.
          - Hydrothecæ swollen below.
            - Hydrothecæ distant, gonangia relatively large .... *picta*.
            - Hydrothecæ not distant, gonangia small .... *megastoma*.
      - Between one-third and three-fourths of adcauline wall adnate.
        - About one-half of adcauline wall adnate.
          - Teeth well marked .... *polyzonias*.
          - Teeth very shallow .... *clausa*.
        - About two-thirds of adcauline wall adnate .... *complexa*.
- Hydrothecæ with three teeth.
  - Teeth of unequal size.
    - Hydrothecæ inclined forward, margin flaring .... *pinnata*.
    - Hydrothecæ not inclined forward, margin flaring .... *margaritacea*.
    - Hydrothecæ not inclined forward, margin not flaring .... *turgida*.
  - Teeth of equal size.
    - Distal part of hydrothecæ narrowing to orifice.
      - Arrangement of hydrothecæ very irregular .... *sieboldi*.
      - Hydrothecæ fairly regular.
        - Branching dichotomous, colony straggling .... *subdichotoma*.
        - Branching alternate.
          - Hydrothecæ with oblique internal marking .... *filiformis*.
          - Hydrothecæ without oblique marking .... *quadrid~~ens~~* tula
    - Distal portion of hydrothecæ expanding.
      - Gonangia large, distal portion turreted .... *meridionalis*.
      - Gonangia smaller, with very conspicuous flaring frills .... *elegans*.

Distal part of hydrothecæ neither expanded nor contracted.
More than two-thirds of adcauline wall adnate .... *milneana.*
Less than one-half adcauline wall adnate.
Adnateness varying greatly, hydrothecæ large .... *magellanica.*
Adnateness fairly constant.
Hydrothecæ very small.
Stem geniculate, gonangia deeply annulated .... *minuta.*
Stem flexuose, gonangia feebly annulated .... *levinseni.*
Hydrothecæ medium or large.
Margins extensively reduplicated .... *dentifera.*
Margins not extensively reduplicated.
Gonangia deeply annulated throughout .... *tricuspidata.*
Proximal part of gonangia smooth .... *tropica.*
Hydrothecæ with two teeth.
Hydrothecæ inclined forward .... *clarkii.*
Hydrothecæ projecting outward .... *episcopus.*
Hydrothecæ immense, teeth inconspicuous .... *magna.*
Hydrothecal margin smooth.
Hydrothecæ perfectly cylindrical .... *formosa.*
Hydrothecæ the shape of the frustum of a cone .... *hartlaubi.*
Hydrothecæ with beveled margins .... *nana.*

SERTULARELLA GAYI (Lamouroux).

(Plate XIV, figs. 1–7.)

Sertularia gayi Lamouroux, Exposition Méthodique, 1821, p. 12.
La Sertularia de Gay de Blainville, Manual d'Actinologie, 1834, p. 481.
Sertularia gayi Lamarck, Hist. nat. anim. sans Vert., 1836, p. 152.
Sertularia polyzonias var. *β*, Johnston, Brit. Hyd. Zooph., 1847, p. 62.
Sertularia gayi Hincks, Ann. and Mag., 3d ser., VIII, 1861, p. 252.
Sertularia gayi Alder, Trans. Tyneside Field Club, V, 1862, p. 237.
Sertularella gayi Hincks, British Hydroid Zoophytes, 1868, p. 237.
Sertularella gayi Sars, Bidrag til Kundskaben om Norges Hydroider, 1873, p. 21
Sertularella gayi var. *robusta* Allman, Porcupine Expedition, 1874, p. 471.
Sertularella gayi Norman, Ann. and Mag., 4th ser., XV, 1875, p. 173.
Sertularella gayi, var. *robusta* Allman, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 22
Sertularella gayi ? Verrill, Check List, 1879, p. 18.
Sertularella gayi Winther, Fortignelse di i Danmark Hydroider, 1880, p. 276.
Sertularella gayi Fewkes, Bull. Mus. Comp. Zool., VIII, No. 7, 1881, p. 128.
Sertularella gayi Kirchenpauer, Nordische Gattungen, 1884, p. 41.
Sertularella gayi Segerstedt, Bihang till K. Svenska Vet.-Akad., 1889, p. 16
Sertularella gayi Bourne, Hydroids of Plymouth, 1890, p. 396.
Sertularella gayi Garstang, Journ. Marine Biol. Assoc., III, 1895, p. 224.
Sertularella gayi Crawford, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularella gayi Nutting, Bahama Expedition, 1895, p. 88.
Sertularella gayi Duerden, Proc. Roy. Dublin Soc., N. S., VIII, 1897, p. 416.
Sertularella gayi Allen, Journ. Marine Biol. Assoc., 1899, p. 452.
Sertularella gayi Bonnevie, Norwegian North Atl. Exped., 1899, p. 76.
Sertularella gayi Hartlaub, Revision Sertularella-Arten, 1900, p. 61.
Sertularella gayi Nutting, Hydroids of Woods Hole Region, 1901, p. 363.
Sertularella gayi Hargitt, American Naturalist, 1901, p. 391.

Trophosome.—Colony straggling in habit, attaining a height of about 6 inches in some cases. Stem fascicled, made up of a number of intertwining and intimately connected tubes, which in the aggregate form a very thick woody stem that bears no trace of internodes or regularity of branching. Branches given off irregularly from the stem, but with a tendency toward a pinnate arrangement. Sometimes a large branch is given off from the main stem which resembles the latter in all particulars, otherwise the branches are nonfascicled, sinuous, divided by oblique nodes into regular internodes, each of which bears a hydrotheca. Hydrothecæ ovate, with the distal ends narrowed and bent slightly outward, adcauline side more or less marked by transverse rugosities, distal two-thirds free, ending in a margin ornamented with four shallow equidistant teeth and an operculum consisting of four valves.

Gonosome.—Gonangia borne on the upper sides of the branches, inserted near the bases of hydrothecæ, long, slender, terete, narrowing to a short, broad pedicle at the proximal end and to a two-toothed margin at the other; the upper one-third to one-half is marked by even shallow annulations.

Distribution.—New England coast (Verrill); Gulf of St. Lawrence (Dawson); common in West Indian region, var. *robusta* (Allman); Bering Sea (*Albatross*); British coasts (Hincks); Shetland (Hincks); between Shetland and Faroe (Allman), where it reaches a depth of 605 fathoms; Swedish west coast (Segerstedt); Norway (Sars); Greenland (Segerstedt); Mediterranean (Graeffe); Africa, Cape of Good Hope (Johnston); *Albatross* Station 2353, lat. N. 20° 59′, long. W. 86° 23′, 167 fathoms; Station 2416, lat. N. 31° 26′, long. W. 79° 07′, 276 fathoms; Station 2663, lat. N. 29° 39′, long. W. 79° 49′, 421 fathoms; Station 2668, lat. N. 30° 58′ 30″, long. W. 79° 38′ 30″, 294 fathoms; Station 2886, lat. N. 43° 59′, long. W. 124° 56′ 30″, 50 fathoms. The following localities are given by Fewkes without the station number: Lat. N. 31° 57′, long. W. 78° 18′ 35″, 333 fathoms; lat. N. 32° 43′ 25″, long. W. 77° 20′ 30″, 233 fathoms; lat. N. 32° 25′, long. W. 77° 42′ 30″, 262 fathoms; lat. N. 32° 07′, long. W. 78° 37′ 30″, 229 fathoms.

The description given above is taken from a specimen from Station 2668, and belongs to the variety *robusta* Allman, which hardly differs in any essential character from the original British form. The species, as indicated above, has a very wide distribution, but has not as yet been found in the Pacific.

SERTULARELLA CONICA Allman.

(Plate XV, figs. 1–2.)

Sertularella conica Allman, Hydroids of the Gulf Stream, 1877, p. 21.
Sertularella conica Clarke, Bull. Mus. Comp. Zool., V, No. 10, 1879, p. 246.
? *Sertularella conica* Calkins, Some Hydroids from Puget Sound, 1899, p. 359.
Sertularella conica Hartlaub, Revision Sertularella-Arten, 1900, p. 66.
Sertularella conica Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 354.

Trophosome.—Colony attaining a height of 1¾ inches. Stem not fascicled, flexuose, divided into regular slender internodes, each of which bears a hydrotheca. Branches irregular and sparse, themselves sometimes branching dichotomously, divided into long, slender internodes, each bearing a hydrotheca. Hydrothecæ distant, rather slender, free for nearly their distal two-thirds, proximal ends swollen, narrowing regularly to their distal end, which is much more slender and narrow than in allied species, the upper side being marked by shallow corrugations; margin with four equal and equidistant teeth and a conical operculum composed of four flaps.

Gonosome.—Not known.

Distribution.—Southwest of Tortugas, 60 fathoms (Allman); lat. N. 24° 34′, long. W. 83° 16′, ? Townsend Harbor (Calkins); *Albatross* Station 2370, lat. N. 29° 18′ 15″, long. W. 85° 32′, 25 fathoms; Station 2388, lat. N. 29° 24′ 30″, long. W. 88° 01′, 35 fathoms; Station 2771, lat. S. 51° 34′, long. W. 68°, 50.5 fathoms.

It is impossible to tell from Calkins's figure and description whether the species that he identified as *S. conica* is correctly determined or not. There is nothing to indicate the number of hydrothecal teeth. The hydrothecæ seem to be very stout and closely approximated for that species. Dr. Torrey[1] identifies a species as *S. conica* that cannot be placed in that species on account of having three instead of four hydrothecal teeth. It seems doubtful that the species has as yet been correctly reported from the Pacific coast.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

[1] Hydroids of the Pacific coast, 1902, p. 60.

SERTULARELLA CATENA (Allman).

(Plate XV, fig. 3.)

Sertularia catena Allman, Challenger Report, Hydroida, Pt. 2, 1888, p. 58.
Sertularella catena Hartlaub, Revision der Sertularella-Arten, 1900, p. 84.

Trophosome.—Colony attaining a height of about 2 inches. Stem fascicled basally and simple distally, geniculate, the distal simple part being divided into regular internodes, each of which is broadened at its distal end to furnish a support for a hydrotheca. Branches roughly alternate, resembling the distal part of the stem as above described. Hydrothecæ subcylindrical, almost wholly exserted, narrowed slightly at each end, the upper (adcauline) sides being marked by shallow rugosities; margin with four shallow teeth that are sometimes reduced to mere sinuosities; operculum imperfect in the type, but probably composed of four parts.

Gonosome.—Gonangia borne on stem opposite the bases of hydrothecæ, large, terete in form; orifice terminal, small, armed with two shallow processes or teeth. There is apparently a series of very shallow rugosities or annulations on the distal portion of the gonangia.

Distribution.—Off Culebra Island, West Indies, 390 fathoms (Allman).

An examination of Allman's type of this species shows that it is not identical with *S. cylindritheca*, as suggested by Hartlaub.[1] The fascicled stem, and not truly cylindrical or quadrate hydrothecæ, and especially the very different shape of the gonangia, show that this species is very distinct from *S. cylindritheca.*

The figure here given is from the type collected by the *Challenger*, and differs somewhat from those of Professor Allman.

Type.—In the South Kensington Museum. Fragment in the possession of the author.

SERTULARELLA QUADRATA Nutting.

(Plate XV, figs. 4–6.)

Sertularella quadrata Nutting, Bahama Expedition, 1895, p. 88.

Trophosome.—Colony attaining a height of about 6 inches. Main stem sinuous, strong, monosiphonic, divided into regular internodes each bearing a hydrotheca. Branches alternate, each internode bearing a hydrotheca immediately at the base of which is the oblique node. Hydrothecæ very long, three to four times as long as wide, quadrate in section, margin with four equal and equidistant teeth and a four-flapped operculum. Hydrothecæ often with margins several times reduplicated, and a number of fine horizontal striations on the outside of the hydrothecal walls.

Gonosome.—Gonangia borne near the hydrothecal bases, broader and stouter than the hydrothecæ, tubular, with rounded bases and distal part quadrate in section. Aperture in the center of the depressed top. Margin surrounded by usually five or six long recurved horizontal spines arranged so as to present a stellate appearance when viewed from above.

Distribution.—Near Habana, Cuba (Nutting); *Albatross* Station 2143, lat. N. 9° 30′ 45″, long. W. 76° 25′ 30″, 155 fathoms; Station 2323, lat. N. 23° 10′ 51″, long. W. 82° 19′ 03″, 163 fathoms; Station 2326, lat. N. 23° 11′ 45″, long. W. 82° 18′ 54″, 194 fathoms; Station 2330, lat. N. 23° 10′ 48″, long. W. 82° 19′ 15″, 121 fathoms; Station 2334, lat. N. 23° 10′ 42″, long. W. 82° 18′ 24″, 67 fathoms.

This very striking form has perhaps the longest hydrothecæ known in the genus *Sertularella.* Its nearest ally is *S. cylindritheca*, from which it differs in the length of the hydrothecæ and also in the form of the gonangia. The reduplication of the margin seems to be here carried to the extreme known in the Sertularidæ.

Type Slides.—Cat. No. 18714, Museum State Univ. of Iowa; Cat. No. 19773, 19778, U.S.N.M.; also in collection of the author.

[1] Revision der Sertularella-Arten, 1900, p. 84.

SERTULARELLA TANNERI, new species.

(Plate XVI, fig. 1.)

Trophosome.—But a fragment of a single branch of this species is known. Branch slightly flexuose, divided into regular internodes, each bearing a hydrotheca, nodes oblique, deep, accompanied by two or three annular rugosities of the perisarc. Hydrothecæ very large, subtubular, the terminal portion being gently curved outward, only a small part of the proximal adcauline wall being adnate to the hydrocaulus; entire hydrothecal wall both above and below regularly and closely annulated; margin squarish, with four low equidistant teeth and a four-flapped operculum.

Gonosome.—Not known.

Distribution.—*Albatross* Station 2873, lat. N. 48° 30′, long. W. 124° 57′, 40 fathoms.

This very striking species shows almost complete intergradation between the *rugosa* and *polyzonias* groups, having the deep annulations of the former with a hydrotheca somewhat resembling the latter in size and shape.

Type.—In the collection of the U. S. National Museum.

SERTULARELLA GENICULATA Hincks.

(Plate XVI, fig. 2.)

Sertularella geniculata HINCKS, Ann. and Mag., 4th ser., XIII, 1874, p. 152.
Sertularella geniculata KIRCHENPAUER, Nordische Gattungen, 1884, p. 44.
Sertularella geniculata LEVINSEN, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 201.

Trophosome.—"Stem slender, decidedly geniculate, simple or slightly branched, jointed and twisted above each calicle; the internodes long, attenuated below and bent in opposite directions. Hydrothecæ very distant, ribbed transversely, chiefly on the upper half, rather broad below, and narrowing gradually toward the margin, which bears four very prominent teeth, is sinuated deeply between them, and is surrounded by a conical quadripartite operculum."

Gonosome.—Unknown.

Distribution.—Off Frederickshaab, Davis Strait (Hincks); Jan Mayen (Lorenz).

I have not seen this species, and the above description is copied entire from the original by Hincks. Hartlaub stoutly contends that this species is identical with *S. tenella*, and he may be right. Not having material for comparison, and in view of the great difference between the description and illustrations of the species as given by Hincks and the typical *S. tenella*, the present writer deems it safer to regard the two species as distinct.

SERTULARELLA PATAGONICA (d'Orbigny).

(Plate XVI, fig. 3.)

Sertularia patagonica D'ORBIGNY, Voyage dans l'Amérique Méridionale, 1839, p. 25.
Sertularella rugosa ? KIRCHENPAUER, Nordische Gattungen, 1884, p. 42.
Sertularella rugosa ? HARTLAUB, Revision der Sertularella-Arten, 1900, p. 122.

"S. ramulis simplicibus, cellulis alternantibus, ovalibus, transversim rugoso-plicatis; vesiculis magius, transversim 10 costato-gradatis." (Original description.)

Trophosome[1].—Colony unbranched, attaining a height of about 1 inch. Stem not fascicled, internodes short, divided by oblique double nodes; hydrothecæ oval, alternate, distal end truncated, provided with six wrinkles in the form of strongly projecting tiers.

Gonosome.—Gonangia very large, resembling the hydrothecæ, oval, ornamented transversely by ten ribs in tiers.

Distribution.—"Bai de Ros," southern Patagonia.

I have not seen this species. Judging from the excellent figures given by d'Orbigny, it does not seem likely that it is the same as *S. rugosa*, as suggested by Kirchenpauer and Hartlaub, the distal extremities of both hydrothecæ and gonangia being entirely different.

[1] Description liberally translated from the original more extended description by d'Orbigny.

SERTULARELLA RUGOSA (Linnæus).

(Plate XVII, figs. 1–5.)

Snail-trefoil Coralline Ellis, Essay Nat. Hist. Coral., 1755, p. 26.
Sertularia rugosa Linnæus, Systema Naturæ, 1758, p. 809.
Sertularia rugosa Houttuyn, Natuurlyke Historie, 1761, p. 539.
Sertularia rugosa Pallas, Elenchus Zoophytorum, 1766, p. 126.
Sertularia rugosa Linnæus, Systema Naturæ, 12th ed., 1767, p. 1308.
Sertularia rugosa Boddaert, Lyst der Plant-Dieren (Pallas), 1768, p. 157.
Sertularia rugosa Maratti, De Plantis Zoophytis, 1776, p. 28.
Sertularia rugosa Fabricius, Fauna Grœnlandica, 1780, p. 443.
Sertularia rugosa Ellis and Solander, Nat. Hist. Zooph., 1786, p. 52.
Sertularia rugosa Wilkins and Herbst, Charakteristik der Thierpflanzen, 1787, p. 164.
Sertularia rugosa Gmelin, Systema Naturæ (Linnæus), 1788, p. 3847.
Sertularia rugosa Esper, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 182.
Sertularia rugosa Berkenhout, Synop. Nat. Hist. Great Britain, I, 1789, p. 216.
Sertularia rugosa Esper, Fortsetzungen der Pflanzenthiere, II, 1794–1806, pl. xi.
Sertularia rugosa Bosc, Hist. Nat. des Vers, III, 1802, p. 93.
Sertularia rugosa Turton, British Fauna, 1807, p. 213.
Sertularia rugosa Jameson, Cat. Anim. Class Vermes, 1811, p. 564.
Sertularia rugosa Lamouroux, Bull. philomatique, 1812, p. 184.
Sertularia rugosa Oken, Lehrbuch der Naturgeschichte, 1815, p. 92.
Sertularia rugosa Lamarck, Hist. Nat. Anim. sans Vert., II, 1816, p. 121.
Clytea rugosa Lamouroux, Hist. Pol. Coral., 1816, p. 203.
Sertularia rugosa Stewart, Elements nat. hist. animal King., 1817, p. 442.
Sertularia rugosa Fleming, British Animals, 1828, p. 542.
Sertularia rugosa Bosc, Hist. Nat. des Vers, 1830, p. 108.
Campanulaire rugueux de Blainville, Manuel d'Actinologie, 1834, p. 473.
Sertularia rugosa Lamarck, Hist. Nat. Anim. sans Vert., 1836, p. 149.
Clytea rugosa Templeton, London Magazine Nat. Hist., 1836, p. 466.
Sertularia rugosa Johnston, Nat. Hist. Soc. Northumb., II, 1837, p. 257.
Sertularia rugosa Johnston, Hist. Brit. Zooph., 1838, p. 123.
Sertularia rugosa Hassall, Ann. and Mag., VI, 1841, p. 167.
Sertularia rugosa Macgillivray, Ann. and Mag., IX, 1842, p. 463.
Sertularia rugosa Thompson, Report Brit. Assoc. for 1843, 1844, p. 283.
Sertularia rugosa Johnston, Hist. Brit. Zooph., 2d ed., 1847, p. 63.
Sertularia rugosa Gray, Brit. Museum Radiata, 1848, p. 69.
Amphitrocha rugosa Stimpson, Invert. Grand Manan, 1853, p. 9.
Sertularia rugosa Alder, Cat. Zooph. Northumb., 1857, p. 23.
Sertularia rugosa Hincks, Ann. and Mag., 3d ser., VIII, 1861, p. 253.
Amphotrocha cincta L. Agassiz, Cont. Nat. Hist. U. S., IV, 1862, p. 356.
Sertularia rugosa Alder, Trans. Tyneside Field Club, V, 1862, p. 289.
Amphitrocha rugosa A. Agassiz, North American Acalephæ, 1865, p. 146.
Sertularia rugosa van Beneden, Fauna Littorale Belgique, 1866, p. 183.
Sertularella rugosa Hincks, Brit. Hydroid Zooph., 1868, p. 241.
Sertularella rugosa Sars, Bidrag til Kundskaben, 1873, p. 44.
Sertularella tenella Schulze, Jahresb. Kanon., Kiel, II, 1874, p. 131.
Sertularella rugosa McIntosh, Ann. and Mag., 4th ser., XIII, 1874, p. 212.
Sertularella rugosa Verrill, Amer. Journ. Sci. and Arts, VII, 1874, p. 133.
Sertularella rugosa Verrill, Amer. Journ. Sci. and Arts, IX, 1875, p. 43.
Sertularella rugosa Clark, Alaskan Hydroids, 1876, p. 224.
Sertularella rugosa Mereschkowsky, Ann. and Mag., 5th ser., I, 1878, p. 190.
Sertularella rugosa Norman, Ann. and Mag., 5th ser., I, 1878, p. 323.
Sertularella rugosa Winther, Naturhist. Tidsskrift, 1880, p. 244.
Sertularella rugosa Kirchenpauer, Nordische Gattungen, 1884, p. 42.
Sertularella rugosa Segerstedt, Bihang K. svensk. Vet.-Akad. Handl., XIV, no. 4, 1889, p. 17.
Sertularella geniculata Marktanner-Turneretscher, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 222.
Sertularella rugosa Fewkes, Guide to Collector, 1890, p. 88.
Sertularella rugosa Hoyle, Proc. Linn. Soc. Zool., XX, 1890, p. 460.
Sertularella rugosa Levinsen, Vid. Udb., "Hauchs" Togter, 1893, p. 388.
Sertularella rugosa Duerden, Proc. Roy. Irish Acad., (3) III, 1893, p. 388.
Sertularella rugosa Hartlaub, Hydromedusen Helgolands, 1897, p. 451.

Sertularella rugosa Crawford, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularella rugosa McIntosh, Ann. and Mag., 6th ser., XVI, 1896, p. 401.
Sertularella rugosa Nutting, Hydroida from Alaska and Puget Sound, 1899, p. 741.
Sertularella rugosa Bonnevie, Norwegian North. Atl. Exped., 1899, p. 77.
Sertularella rugosa Hartlaub, Revision der Sertularella-Arten, 1900, pp. 54, 121, pl. vi, fig. 12.
Sertularella rugosa Nutting, Hydroids of the Woods Hole Region, 1901, p. 362.
Sertularella rugosa Hargitt, American Naturalist, 1901, p. 391.
Sertularella saccata Nutting, Hydroids Harriman Expedition, 1901, p. 183.
Sertularella rugosa Whiteaves, Cat. Marine Invert. eastern Canada, 1901, p. 25.
Sertularella rugosa Sæmundsson, Bidrag til Kundskaben islandske Hydroider, 1902, p. 67.

Trophosome.—Colony attaining a height of about three-fourths of an inch. Stem usually unbranched, with several deep annulations on the proximal end, and regular short internodes, each bearing a hydrotheca and usually several annulations; nodes very deeply cut and oblique. Hydrothecæ not contiguous, barrel-shaped, ornamented with four to six annular rugosities, ending in a short ill-defined square collar; margins square, with four ill-defined teeth and a four-flapped operculum.

Gonosome.—Gonangia large, ovate to almost globular, with a number of annular rugosities and a small aperture armed with four ill-defined teeth.

Distribution. New England coast (Verrill); Grand Manan (Stimpson); West Indies (Nutting); Alaska (Clark); Puget Sound (Nutting); British coasts (Hincks); Norway (Sars); North Cape (Sars); Greenland (Levinsen); Denmark (Winther); Iceland (Sæmundsson); Sweden (Segerstedt); White Sea (Mereschkowsky); Helgoland (Hartlaub); coast of Belgium (van Beneden).

This wide ranging species is quite variable, as would be expected, and the writer has found specimens from our Atlantic coast that agree quite well with his *S. saccata* from Alaska.

SERTULARELLA AREYI, new species.

(Plate XVII, fig. 6.)

Trophosome.—A fragmentary specimen was all that was secured. It was about one-fourth of an inch high. Stem unbranched, very slender, internodes longer in proportion to their thickness than any others of the genus that I have seen, each bearing a hydrotheca near its distal end. Hydrothecæ barrel-shaped, very distant, margin square with four obscure teeth and a four-flapped operculum; hydrothecal body marked by two very distinct annular rugosities which divide the body into three nearly equal zones. The surface is further ornamented with distinct longitudinal lines or fine ridges.

Gonosome.—Unknown.

Distribution.—Dredged near Habana, 100 to 200 fathoms, Bahama Expedition from the State University of Iowa.

This very distinct and beautiful species I take pleasure in naming after my friend Professor Arey, of Cedar Falls, Iowa, one of the members of the expedition that secured the type specimen.

Type slide.—Cat. No. 18693.

Museum of Natural History, State University of Iowa.

SERTULARELLA TENELLA (Alder).

(Plate XVIII, figs. 1–2.)

Sertularia rugosa (var.) Johnston, British Zoophytes, 2d ed., 1847, I, p. 64, and fig. *c*, p. 62.
Sertularia tenella Alder, Cat. Zooph. Northumb., 1857, p. 23.
Sertularia tenella Hincks, Ann. and Mag., 3d ser., VIII, 1861, p. 253.
Sertularia tenella Norman, Report British Assoc., 1867, p. 200.
Sertularella tenella Hincks, Brit. Hyd. Zooph., 1868, p. 242.
Sertularella tenella Hincks, Ann. and Mag., 4th ser., XIII, 1874, p. 153.
Sertularella tenella McIntosh, Ann. and Mag., 4th ser., XIII, 1874, p. 212.
Sertularella tenella Schulze, Nordsee Exped., 1874, p. 131.
Sertularella tenella Winther, Naturhist. Tidsskrift (3), XII, 1880, p. 245.
Sertularella tenella Kirchenpauer, Nordische Gattungen, 1884, p. 44.
Sertularella tenella Segerstedt, Bidrag til Kännedomen Hydroid faunen, 1889, p. 17.
Sertularella tenella Levinsen, Vid. Meddel. Naturhist. Foren., 1892, p. 59.

?*Sertularella angulosa* Bale, Proc. Royal Soc. New South Wales, 1893, p. 102.
Sertularella tenella Crawford, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularella tenella Bonnevie, Norwegian North Atl. Exped., 1899, p. 77.
Sertularella tenella Hartlaub, Revision der Sertularella-Arten, 1900, p. 63.
Sertularella tenella Hartlaub, Hydroiden aus dem Stillem Ocean, 1901, p. 354.
Sertularella tenella Torrey, Hydroida of the Pacific Coast, 1902, p. 64.

Trophosome.—Colony small, not reaching a height of more than one-half inch in specimens examined. Main stem slender, strongly geniculate, divided into regular long internodes, each of which bears a hydrotheca. Branches, if present, few, like the main stem, divided into regular internodes, each bearing a hydrotheca. Hydrotheca distant, fusiform, strongly rugose, almost their whole length exserted, aperture square, mounted on a short quadrate collar which has four equal and equidistant teeth; operculum with four flaps.

Gonosome.—"Gonangia ovate, slender, ringed transversely, produced above into a short tubular orifice."[1]

Distribution.—*Albatross* Station 2333, lat. N. 23° 10′ 36″, long. W. 82° 19′ 12″, 169 fathoms; *Albatross* Station 2865, lat. N. 48° 12′, long. W. 122° 49′, 40 fathoms; Puget Sound (Hartlaub); California (Torrey); Rio de Janeiro (Rathbun); British Coasts (Hincks); Norwegian Coast (Bonnevie); Greenland (Levinsen). If *S. angulosa* Bale is a synonym of *S. tenella*, the range of the species will have to be extended to Australia.

I cannot agree with Hartlaub that *S. geniculata* Hincks[2] and *S. microgena* von Lendenfeld[3] are synonyms of this species. Specimens dredged by the U. S. Fish Commission steamer *Albatross* and off the Alaskan coast are quite typical, as are the fragments collected by Doctor Richard Rathbun off Rio de Janeiro.

Type.—In Museum of the Natural History Society, Newcastle-upon-Tyne, England.

SERTULARELLA ALLMANI Hartlaub.

(Plate XVIII, figs. 3–6.)

Sertularella unilateralis Allman, Ann. and Mag., 4th ser., XVII, 1876, p. 114.
Sertularella unilateralis Allman, Phil. Trans. Royal Society, London, V, 1879, p. 282.
Sertularia secunda Allman, Challenger Report, The Hydroids, Pt. 2, 1888, pl. xxv, fig. 2. (Explanation of plate.)
Sertularia unilateralis Allman, Challenger Report, The Hydroids, Pt. 2, 1888, p. 53.
Sertularella allmani Hartlaub Revision der Sertularella-Arten, 1900, p. 81.
?*Sertularella antarctica* Hartlaub, Revision der Sertularella-Arten, 1900, p. 82.

Trophosome.—Colony attaining a height of about one-half inch, growing in a dense tuft. Stem slender, much annulated below, divided into fairly regular internodes by deep nodes. Branches alternate, dividing several times into branchlets, the ultimate division being dichotomous, lying in two planes, projecting forward, outward, and upward from the stem, divided into regular internodes, each of which usually bears a hydrotheca, or a hydrotheca with a branchlet borne at the side of its base. Hydrothecæ lying in two planes projecting forward, outward, and upward, so that they appear in side view to be all inserted on one side of the branch. Hence the name "*unilateralis*." Hydrothecæ flask-shaped, rather small, about the distal one-half of adcauline wall free, aperture quadrate, margin with four conspicuous slender sharply-pointed teeth, the anterior pair being the longer, and a narrow, even border. Operculum of four flaps.

Gonosome.—Gonangia rather large, ovoid to obconical, annulated on upper half and sometimes throughout, aperture rather large, and margin with five or six blunt teeth. Acrocysts present when sexual products are mature.

Distribution—Off Accessible Bay, and Swains Bay, Kerguelen Island (Allman); Tierra del Fuego, Point Stanley (Hartlaub); Straits of Magellan (Hartlaub); *Albatross* Station 2776, Straits of Magellan.

This is a very variable species, and the quite considerable amount of material collected by the United States Fish Commission Steamer *Albatross* in the Straits of Magellan shows the identity of the species named in the synonymy above. The gonangia are particularly variable,

[1] Hincks, British Hydroid Zoophytes, 1868, p. 242.
[2] Annals and Magazine of Natural History, 4th ser., XIII, 1874, p. 152.
[3] Proceedings of the Linnæan Society of New South Wales, IX, 1884, p. 416.

especially in the matter of the marginal teeth and the size of the aperture, specimens agreeing with all of the figures given by Allman and Hartlaub being found in a single colony. The thickness of the perisarc described by Hartlaub is characteristic of his specimens of *S. antarctica* (=*S. unilateralis* Allman) is not mentioned by Allman and is not apparent in the specimens collected by the *Albatross*. It is possible that *S. antarctica* is not the same as *S. unilateralis* Allman, but a distinct species. Hartlaub claims that the name *Sertularella unilateralis* Allman (1879) must be abandoned. The facts appear to be that Hartlaub (Revision p. 42) changes the name *Sertularia unilateralis* Lamouroux (1824) to *Sertularella unilateralis* (Lamouroux), thus securing the priority of the name for Lamouroux's species, by a strict application of the A. O. U. Code. It therefore became necessary to give new names to *Sertularella unilateralis* Allman and *Sertularia unilateralis* Allman, species which seem to the present writer identical.

Type.—In South Kensington Museum, London.

SERTULARELLA CONTORTA Kirchenpauer.

(Plate XVIII, figs. 7–9.)

Sertularella contorta KIRCHENPAUER, Nordische Gattungen, 1884, p. 29.
Sertularella protecta HARTLAUB, Revision der Sertularella-Arten, 1900, p. 79.
Sertularella contorta HARTLAUB, Revision der Sertularella-Arten, 1900, p. 83.

Trophosome.—Colony attaining a height of about 3 inches in type specimen. Stem not fascicled, thick, divided into fairly regular internodes each of which bears a branch and hydrotheca, or a hydrotheca alone; internodes much broadened at their distal ends by a shoulder for the support of the hydrotheca; nodes deep and distinct, there being corrugations or constrictions in addition to the regular nodes giving a twisted appearance to the stem and branches. Branches irregularly alternate, flexuose, their bases with several annular constrictions, divided into regular internodes resembling those of the stem. Hydrothecæ heavy, thick in texture, distal half free and curving outward, margin with a distinct thickened rim and four teeth, the two abcauline ones usually being more pronounced than the adcauline ones. Operculum not seen in specimen described, although Hartlaub figures a four-flapped operculum.

Gonosome.—Gonangia large, axillary, obovate or obconical in outline, or terete as in the type, with a short neck shaped like the frustum of a cone, and two prominent teeth in the specimen figured, without teeth in the one figured by the original describer; strongly annulated throughout in the specimen figured, but smooth in the middle portion as figured by Kirchenpauer.

Distribution.—Falkland Island and the Straits LaMarre (Kirchenpauer).

The description given above is made mainly from a specimen kindly sent me by Professor Levinsen, labeled "Lamarre Straits," the locality from which the type specimen was secured. In the trophosome it agrees well with the original description and figure given by Kirchenpauer, but the gonangia are quite different, although there is one gonangium that is much nearer the type than the one figured in this work. The specimen agrees very well with *S. protecta* Hartlaub, which I therefore regard as a synonym.

Type.—In the Museum of Leipsic?

SERTULARELLA LATA (Bale).

(Plate XVIII, fig. 10.)

Thuiaria lata BALE, Journ. Microsc. Soc., Victoria, 1882, p. 14.
Thuiaria lata BALE, Cat. Australian Hydroid Zoophytes, 1884, p. 120.
Thuiaria hyalina ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 69.

Trophosome.—Colony attaining a height of 6 or 8 inches (Bale). Stem fascicled below, not fascicled above, where it is thick, divided into regular internodes each of which bears a branch and two hydrothecæ on one side and a single hydrotheca on the other. Whole hydrocaulus remarkably translucent and hyaline in structure. Branches alternate, distant, only slightly constricted at their origin, divided into regular, usually long internodes. Hydrothecæ alternate, widely separated by the thickness of the stem, closely approximated, tubular, completely adnate to aperture on adcauline side, not apparently swollen or gibbous below, margin with a delicate

but evident rim and four inconspicuous equidistant teeth which are sometimes aborted leaving an even margin. The remains of an operculum can be seen in some cases, and this is probably composed of four flaps.

Gonosome.—Not known.

Distribution.—Griffiths Point, Port Stevens, Queen's Cliff, Victoria (Bale); Station 126, south of Pernambuco, 770 fathoms (Allman).

An examination of Allman's type of *Thuiaria hyalina* Allman shows that the species comes well within the genus *Sertularella* as used in the present work. The entire structure is very delicate, and the operculum is in no case perfect. In some cases, however, it is partially intact, and is probably composed of four flaps where the four low teeth are present, and of a single thin membrane where the teeth are wanting, leaving a circular margin. Bale's figures and descriptions of *Thuiaria lata* Bale apply so completely to the Challenger type of *T. hyalina* Allman before me that I have no hesitation in regarding the two as identical. As Bale's species has the priority, Allman's *T. hyalina* must be regarded as a synonym.

Type.—In Australian Museum, Sydney.

SERTULARELLA ALBIDA Kirchenpauer.

(Plate XIX, figs. 1–2.)

Sertularella robusta, CLARK, Alaskan Hydroids, 1876, p. 225.
Sertularella albida, KIRCHENPAUER, Nordische Gattungen, 1884, p. 42.
Sertularella albida, HARTLAUB, Revision der Sertularella-Arten, 1900, p. 26.

Trophosome.—Colony attaining a height of about 2 inches, flabellate in form. Stem not fascicled, thick, with several very deep annulations at its proximal end, internodes irregular, tending to be shorter in proximal and longer in distal portion, nodes very deeply cut. Branches flexuose, irregularly alternate, themselves branching, divided into irregular internodes like those of the stem, very broad, resembling those of *Thuiaria*. Hydrothecæ large, closely approximated, alternate, but on account of the thickness of the hydrocaulus appearing to be in two series as in many species of *Thuiaria;* broadly tubular, immersed to the aperture on abcauline side, distal part bending slightly outward, margin with four teeth. Operculum of four flaps. An intrathecal ridge originates at the bend in the abcauline side and passes downward and inward to about the middle of the hydrotheca.

Gonosome.—Gonangia axillary, very large, perhaps the largest found in the genus, ovate, regularly and closely annulated with short tubular neck, and round terminal aperture.

Distribution.—Yukon Harbor, Big Koniushi, Shumagin Islands, 6 to 20 fathoms. Collected by W. H. Dall (Clark).

This very striking species has the aspect of a *Thuiaria* and would doubtless be placed in that genus were it not for the four-toothed hydrothecal margin and the typical *Sertularella* form of the gonangia. These latter are very large indeed, attaining sometimes a length of nearly a quarter of an inch. The description and figures are from a specimen collected by Dall at Big Koniushi, Shumagin Islands.

Type.—In Museum of the Academy of Sciences, St. Petersburg.

?SERTULARELLA PINNIGERA Hartlaub.

(Plate XIX, fig. 3.)

Thuiaria pinnata ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 28.
Sertularella ?pinnata HARTLAUB, Revision der Sertularella-Arten, 1900, p. 113.
Sertularella pinnigera HARTLAUB, Revision der Sertularella-Arten, 1900, p. 113.

"*Trophosome.*—Stem attaining a height of nearly 3 inches, sparingly branched, fascicled below, alternately pinnate, pinnæ given off at nearly right angles to the stem, jointed at distant and uncertain intervals. Hydrothecæ borne both by stem and pinnæ, deep cylindrical with obscurely four-toothed margin, adnate to the axis in their whole length.

"*Gonosome.*—Not known."

Distribution.—Double-headed Shot Key, 3 to 4 fathoms (Allman).

There is considerable doubt as to the systematic position of this species. The large and nonretractile hydranth, as represented in Allman's figure, resembles those of *Halecium*, as does also the thick and strongly fascicled stem. The above description is copied entire from Allman.

Type.—In Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARELLA CYLINDRITHECA (Allman).

(Plate XIX, fig. 4.)

Sertularia cylindritheca ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 59.
Sertularia cylindritheca VERSLUYS, Hydraires Calypt. Mer des Antilles, 1899, p. 36.
Sertularella cylindritheca HARTLAUB, Revision der Sertularella-Arten, 1900, p. 77 (part).

Trophosome.—Colony attaining a height of about 4 inches. Stem not fascicled, geniculate, divided into regular internodes, each of which bears a hydrotheca. Branches irregularly alternate, themselves sometimes dividing dichotomously and resembling the main stem. Hydrothecæ large, cylindrical proximally and quadrate in cross section distally, almost entirely free, the adcauline side only being slightly adnate, about twice as long as broad; aperture quadrate, margin armed with four equal and equidistant teeth. Operculum of four flaps.

Gonosome.[1]—Gonangia borne near the bases of the hydrothecæ, pedicel short, body shaped much like the hydrothecæ, being cylindrical below and quadrate above. Distal end with broadly expanded margin, which is quadrate and armed with four large flaring teeth. There are numerous fine annular rugosities running around the whole gonangium, except on the proximal portion.

Distribution.—Off Bahia, Brazil (Allman); West Indies (Versluys); Trinidad, specimen in United States National Museum.

Versluys calls attention to the unfortunate name given this species by its original describer, Allman. The hydrothecæ are distinctly quadrangular in cross section, except at the base, and hence the name "*cylindritheca*" is misleading. I am indebted to the authorities of the South Kensington Museum for a part of the type collected by the *Challenger*, from which the accompanying drawing was made.

Type.—In the collection of the South Kensington Museum. Fragment in possession of the author.

SERTULARELLA GIGANTEA Mereschkowsky.

(Plate XIX, fig. 7.)

Sertularella gigantea MERESCHKOWSKY, Ann. and Mag., 5th Ser., I, 1878, p. 330.

Trophosome.—"The tolerably flexible stems spring from the branched hydrorhiza often without ramifying; sometimes they divide at their base into two or three branches, each of which may again ramify once more; the terminal branches are in all cases very long and straight. The hydrothecæ are evidently alternately arranged upon the angularly bent stem; frequently we observe three or four undulations (ribs) crossing the hydrothecæ; its form is much elongated, only a little widened at its base; in size it is two or three times the length of the hydrotheca of *S. polyzonias*. In adult individuals the margins are always furnished with several ledges and an equal number of small opercula placed one above the other. Below each hydrotheca the stem is slightly ringed."

Gonosome.—Unknown.

Distribution.—White Sea. (Mereschkowsky.)

The above description is quoted entire from that of the original describer. Mereschkowsky believes that this species is the same as *S. polyzonias* var. *gigantea* Hincks, a position positively denied by Hincks, who seems to me to have the better of the argument. Hartlaub[2] considers *S. quadricornuta* Hincks as a synonym of *S. polyzonias*, which does not appear from a comparison of the original descriptions of the two. He also considers the *S. polyzonias*, found in Alaska and

[1] Description taken from Versluys, reference in synonymy, who was the first to describe it.

[2] Revision der Sertularella-Arten, 1900, p. 20.

described by Clark,[1] as equal to *S. gigantea* Mereschkowsky. I have this specimen from Dall's collection from Alaska, and it is a typical *S. polyzonias.* The size of this species in connection with the very pronounced reduplication of the hydrothecal margins, if constant, as the describer claims, seem sufficient characters to mark it as a distinct species, not identical with *S. polyzonias*, var. *gigantea* Hincks or var. *robusta* Clark.

SERTULARELLA DISTANS (Allman).

(Plate XIX, figs. 5-6.)

Thuiaria distans ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 27.
Sertularella distans HARTLAUB, Revision Sertularella-Arten, 1900, p. 100.

Trophosome.—Colony plumose, attaining a height of about 4 inches. Stem not fascicled, not canaliculated (in specimens examined by me), flexuose, divided into regular internodes each of which bears two hydrothecæ and a branch on one side and a single hydrotheca on the other. Branches alternate, distant, nodes very distant or absent, divided from the stem by a deep constriction. Hydrothecæ distant, alternate, immersed to the margin on adcauline side, broadest at margin, gradually narrowing downward, margin with a narrow but distinct border and four very low and inconspicuous teeth; operculum very delicate and hard to interpret, apparently of four flaps.

Gonosome.—Not known.

Distribution.—Tortugas, shallow water (Allman); Shallow water between Eleuthera and Little Cat Islands (Bahama Expedition from the State University of Iowa); *Albatross* Station 2324, lat. N. 23° 10′ 25″, long. W. 82° 20′ 24″, 33 fathoms; Station 2353, lat. N. 20° 59′, long. W. 86° 23′, 167 fathoms; Station 2414, lat. N. 25° 4′ 30″, long. W. 82° 59′ 15″, 26 fathoms.

Specimens collected by the Expedition from the State University of Iowa were compared directly with Allman's type in the Museum of Comparative Zoology at Harvard, and were found to agree. There is no doubt that this species is very near *S. lata* (Bale), but the hydrothecæ are more distant in *S. distans*, and the entire structure is more corneous and much less delicate and hyaline.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARELLA AMPHORIFERA Allman.

(Plate XX, figs. 1-2.)

Sertularella amphorifera ALLMAN, Mem. Mus. Comp. Zool., V, 1877, p. 22.
Sertularella amphorifera CLARKE, Bull. Mus. Comp. Zool., V, 1879, p. 246.
Sertularella amphorifera HARTLAUB, Revision der Sertularella-Arten, 1900, p. 23.

Trophosome.—Colony (fragmentary) about one-third inch high, stem not fascicled, flexuose, slender, dichotomously branched, divided into very long internodes each of which bears a hydrotheca near its distal end. Branches like the stem. Hydrothecæ tubular, long, gracefully curved, adnate for about their proximal third, margin four-toothed?, reduplicated, or at least the distal parts of the hydrothecæ are marked by parallel horizontal lines that seem to indicate reduplication.

Gonosome.—"Gonangia springing each from a point near the base of a hydrotheca; obovate, strongly annulated, rapidly narrowing to its point of attachment and terminating distally in a conical neck, which carries on its summit a small circular orifice with everted margin." (Allman.)

Distribution. Off Double-headed Shot Key, 471 fathoms (Allman); Lat. N. 25° 33′, long. W. 83° 16′, 101 fathoms, abundant (Clarke); *Albatross* Station 2354, lat. N. 20° 59′ 30″, long. W. 86° 25′ 33″, 101 fathoms.

The fragment from which the above description of the trophosome was taken differs from Allman's description in having apparently four teeth to the hydrotheca. This may be due, however, to mutilation of the specimen, the hydrothecal margin being apparently worn and perhaps broken.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

[1] Alaskan Hydroids, 1876, p. 224.

SERTULARELLA FUSIFORMIS (Hincks).

(Plate XX, figs. 3–4.)

Sertularia fusiformis Hincks, Ann. and Mag., 3d ser., VIII, 1861, p. 253.
Sertularia fusiformis Norman, Report British Assoc., 36th meeting, 1867, p. 200.
Sertularella fusiformis Hincks, Brit. Hydroid Zooph., 1868, p. 243.
Sertularella fusiformis Graeffe, Arb. Zool. Inst., Wien und Triest, V, 1884, p. 356.
Sertularella fusiformis Pieper, Zool. Anz., VII, 1884, p. 185.
Sertularella fusiformis Carus, Prodromus Faunæ Medit., I, 1885, p. 12.
Sertularella fusiformis Hoyle, Journ. Linn. Soc., Zool., XX, 1890, p. 460.
Sertularella fusiformis Thornely, Trans. Biol. Soc. Liverpool, VIII, 1894, p. 7.
Sertularella fusiformis Babic, Rad. Jugosl. Ak., CXXXIV, 1898, p. 37.
Sertularella fusiformis Hartlaub, Revision der Sertularella-Arten, 1900, p. 85.
Sertularia fusiformis Whiteaves, Cat. Marine Invert. Eastern Canada, 1901, p. 26.
Sertularella fusiformis Torrey, Hydroida of Pacific Coast, 1902, p. 61.

Trophosome.—Colony minute, stem slender, slightly zigzag, generally unbranched, annulated at the base and below each hydrotheca; hydrothecæ alternate, bent in opposite directions, elongate, somewhat flask-shaped, smooth, aperture quadridentate, with an operculum composed of four pieces; each hydrotheca and its internode of a fusiform figure.

Gonosome.—Gonangia elongate, slender, tapering above and below, ribbed across, produced at the upper extremity into a short neck and toothed, springing here and there just below a hydrotheca. Height about a quarter of an inch.

Distribution.—Devonshire, England (Hincks); Hebrides (Norman); Gulf of St. Lawrence 200 fathoms (Whiteaves); San Francisco, California (Torrey); Mediterranean (Carus); (?) New Zealand, *S. simplex* Hutton.

I have never seen this species and the above description is taken almost entire from the original description by Hincks, the only changes being in the substitution of the words "hydrothecæ" and "gonangia" for "cells" and "gonothecæ" and in the addition of the words "trophosome" and "gonosome" to conform to the plan of description of this work.

SERTULARELLA SOLITARIA, new species.

(Plate XX, figs. 10–11.)

Trophosome.—Hydrocaulus a monosiphonic stolon from which spring peduncles which bear hydrothecæ and have one or two annulations near their middle. Hydrothecæ radially symmetrical, long, fusiform, tapering basally where they merge insensibly into the peduncles, and distally to a square neck and quadrate margin which is slightly everted and is produced into four strong equidistant teeth. The entire body of the hydrotheca is strongly and evenly annulated. Operculum of four flaps. The hydranth was seen in one specimen, and what appeared to be opercular muscles were evident.

Gonosome.—Not known.

Distribution.—Shallow water, between Eleuthera and Little Cat Islands, Bahamas. Dredged by the Bahama Expedition from the State University of Iowa. Found growing as a parasite on *Nematophorus grandis.*

This curious form is placed provisionally in this genus. At first thought one would consider it a young specimen of a species belonging to the *rugosa* group, which as yet had developed but a single hydrotheca. I have, however, not seen any young specimen of any regular sertularian in which the hydranth and operculum had been fully formed and in which there was no indication of another hydrotheca or internode springing from the side of the first hydrotheca. If the hydrothecæ were sessile the species would be very near Allman's genus *Calamphora*, which he regards as a campanularian, but which Hartlaub[1] and the present writer regard as belonging to the genus *Sertularella* on account of the form of the hydrotheca and particularly the margin and operculum. *S. solitaria* appears to be almost exactly intermediate between the

[1] Revision der Sertularella-Arten, 1900, p. 12.

campanularian and sertularian types, agreeing with the former in the fact that the hydrothecæ are radially symmetrical and pediculate and with the latter in the structure of the hydrothecæ and operculum. Were it not for the presence of the hydranths this form could readily be mistaken for the gonangia of *S. fusiformis*, although the hydrothecæ are more slender than any representation of the gonangia of *S. fusiformis* that I have seen. It is, of course, possible that older specimens will demonstrate that the adult colony resembles that of *S. fusiformis* in the manner of branching, but the hydrothecæ are readily distinguished.

Type slide.—Cat. No. 18717, Museum of State University of Iowa.

SERTULARELLA PICTA (Meyen).

(Plate XX, figs. 5–7.)

Sertularia picta Meyen, Über Leuchten des Meeres, 1834, p. 201.
Sertularella picta Hartlaub, Revision der Sertularella-Arten, 1900, p. 77.

Trophosome.—Colony growing in dense masses and attaining a height of 6 to 8 inches. Branches alternate, divided into regular internodes each bearing a hydrotheca and divided by one or two annular constrictions. Hydrothecæ alternate and axillary. Margin with four small teeth and a small opening, owing to an internal thickening of the perisarc near the margin.

Gonosome.—Gonangia alternating with the hydrothecæ, evenly annulated throughout and with four marginal teeth.

Distribution.—On the East Coast of Terra del Fuego and near the Falkland Islands (Meyen); Puerto Toro and Lennox Island (Hartlaub).

Hartlaub, who has examined the type, says that Meyen is in error in saying that the gonangia alternate with the hydrothecæ, and that the presence of the hydrothecal teeth is uncertain. Hartlaub and Kirchenpauer both suggest the identity of this species and *S. gaudichaudii* Lamouroux.[1]

Type.—In the Berlin Museum.

SERTULARELLA MEGASTOMA, new species.

(Plate XX, figs. 8–9.)

Trophosome.—Colony rigid, compact, pinnate, the single fragmentary specimen known attaining a height of about 2 inches. Stem fascicled, straight, without evident internodes, color dark brown. Branches regularly alternate, rigid, without evident constrictions at base and without evident internodes. Hydrothecæ cylindrical or subconoid, outer profile nearly straight, without evident swelling at base, distal two-thirds of adcauline wall free. No noticeable constriction near distal end, margin square with four low but evident teeth. Operculum of four valves.

Gonosome.—Gonangia borne on branches, small, oblong-ovoid, regularly and deeply annulated, with a very large quadrate aperture, and without an evident neck.

Distribution.—*Albatross* Station 2353, lat. N. 20° 59′, long. W. 86° 23′, 167 fathoms.

This very distinct species has a particularly rigid habit of growth, without the sinuous bends to its stem and branches almost universally found in the genus. The small gonangia are unique in the genus, so far as I know, in the very large size of the quadrate aperture.

Type slides.—Cat. Nos. 19765, 19766, U.S.N.M. Cat. No. 18708, Museum State University of Iowa; also in collection of the author.

SERTULARELLA POLYZONIAS (Linnæus).

(Plate XXI, figs. 1–2.)

Great Tooth Coralline Ellis, Essay Nat. Hist. Corallines, 1755, p. 5.
Sertularia polyzonias Linnæus, Systema Naturæ, 1758, p. 813.
Sertularia flexuosa Linnæus, Systema Naturæ, 1758, p. 814.
Sertularia polyzonias Linnæus, Fauna Suecica, 1761, p. 541.
Sertularia flexuosa Linnæus, Fauna Suecica, 1761, p. 542.

[1] See Hartlaub, Revision der Sertularella-Arten, 1900, p. 77, and Kirchenpauer, Nordische Gattungen und Arten, 1884, p. 38.

Sertularia polyzonias HOUTTUYN, Natuurlyke Historie, XVII, 1761–73, p. 572.
Sertularia ericoides PALLAS, Elenchus Zoophytorum, 1766, p. 127.
Sertularia polyzonias LINNÆUS, Systema Naturae, 1767, p. 1312.
Sertularia ericoides BODDAERT, in Pallas, Lyst der Plant-Dieren, 1768, p. 158.
Sertularia polyzonias FORSKÅL, Descriptiones Animalium, 1775, p. 27 (note).
Sertularia ciliata FABRICIUS, Fauna Groenlandica, 1780, p. 446.
Sertularia polyzonias CAVOLINI, Fil. Memorie per servire alla storia de Polipi marini, 1785, p. 224.
Sertularia polyzonias ELLIS and SOLANDER, Nat. Hist. Zooph., 1786, p. 37.
Sertularia ericoides WILKINS and HERBST, in Pallas, Charakteristik der Thierpflanzen, 1787, p. 165.
Sertularia polyzonias GMELIN, in Linnæus, Systema Naturæ, 1788–93, p. 3856.
Sertularia polyzonias ESPER, Die Pflanzenthiere in Abbildungen, III, 1788, p. 173.
Sertularia polyzonias BERKENHOUT, Synop. nat. hist. Great Britain and Ireland, I, 1789, p. 219.
Sertularia polyzonias OLIVI, Zoologica Adriatica, 1792, p. 290.
Sertularia polyzonias ESPER, Fortsetzungen der Pflanzenthiere, II, 1794–1806, pl. VI.
Sertularia polyzonias BOSC, Hist. nat. des Vers, III, 1802, p. 100.
Sertularia polyzonias TURTON, British Fauna, 1807, p. 216.
Sertularia polyzonias BERTOLONI, Rariorum Italiæ plantarum, 1810, p. 108.
Sertularia polyzonias JAMESON, Cat. animals class Vermes, 1811, p. 564.
Sertularia polyzonias LAMOUROUX, Bullet. Soc. philomatique, 1812, p. 184.
Sertularia polyzonias SPRENGEL-CAVOLINI, Abhand. über Pflanzen Thiere, 1813, p. 104.
Sertularia ericoides OKEN, Lehrb. der Naturgeschichte, Pt. 3, 1815, p. 92.
Sertularia polyzonias LAMARCK, Hist. nat. anim. sans Vert., II, 1816, p. 117.
Sertularia polyzonias LAMOUROUX, Hist. coral flex., 1816, p. 190.
Sertularia polyzonias STEWART, Elements nat. hist. anim. King., II, 1817, p. 447.
Sertularia polyzonias BERTOLONI, De plantis in itinere ad urben Ravennæ, 1819, p. 218.
Sertularia polyzonias BERTOLONI, Specimen zoophytorum Portus Lunæ, 1819, p. 271.
Sertularia polyzonias GOLDFUSS, Handbuch der Zoologie, 1820, p. 88.
Sertularia polyzonias BLUMENBACH, Handb. d. Naturg., 1821, p. 298.
Sertularia polyzonias DELLE CHIAJE, Anim. s. Vert. Nap., IV, 1823, p. 141.
Sertularia polyzonias DELONGSCHAMPS, Encyclop. méth., 1824, p. 681.
Sertularia polyzonias RISSO, L'Europe mérid., V, 1826, p. 310.
Sertularia polyzonias BENNET and VAN OLIVIER, Natuurk. Verh. Holl. Maatsch., 1826, XV, p. 195.
Sertularia polyzonias DELLE CHIAJE, Mem. de Anim. senza Vert., IV, 1828, p. 128.
Sertularia polyzonias FLEMING, British Animals, 1828, p. 542.
Sertularia polyzonias DE BLAINVILLE, Manuel d'Actinologie, 1834–1837, p. 480.
Sertularia polyzonias TEMPLETON, Loudons Mag. Nat. Hist., IX, 1836, p. 468.
Sertularia pinnata TEMPLETON, Loudons Mag. Nat. Hist., IX, 1836, p. 468.
Sertularia polyzonias LAMARCK, Hist. Nat. anim. sans Vert., 1836, p. 142.
Sertularia polyzonias JOHNSTON, Trans. Newcastle Soc., II, 1837, p. 256.
Sertularia polyzonias COUCH, Cornish Fauna, III, 1838, p. 17.
Sertularia ellisii JOHNSTON, British Zooph., 1838, p. 124.
Sertularia ellisii COUCH, Cornish Fauna, III, 1838, p. 17.
Sertularia polyzonias THOMPSON, Ann. and Mag., V, 1840, p. 250.
Sertularia pinnata THOMPSON, Ann. and Mag. Nat. Hist., V, 1840, p. 250.
Sertularia polyzonias HASSALL, Ann. and Mag., VI, 1841, p. 167.
Sertularia pinnata GOULD, Report Invert. Anim. of Mass., 1841, p. 350.
Sertularia ellisii COUCH, Zooph. Cornwall, 1841, p. 6.
Sertularia polyzonias COUCH, Zooph. Cornwall, 1841, p. 6.
Sertularia polyzonias THOMPSON, Report Brit. Assoc. for 1843, 1844, p. 283.
Sertularia polyzonias JOHNSTON, Brit. Zooph., 2d ed., 1847, p. 61.
Sertularia polyzonias DALYELL, Remark. Animals of Scotland, I, 1847, p. 134.
Sertularella polyzonias GRAY, British Radiata, 1847, p. 68.
Sertularia polyzonias FORBES, Report 20th Meeting Brit. Assoc., 1850, p. 245.
Sertularia polyzonias MAITLAND, Fauna Belgii septemtrionalis, 1851, p. 47.
Sertularia polyzonias STIMPSON, Marine Invert. Grand Manan, 1853, p. 9.
Sertularia polyzonias MÖRCH, Beskr. af Grönlands, 1857, p. 97.
Sertularia polyzonias SARS, Bidrag til Kundskaben, 1857, p. 54.
Sertularia polyzonias VON ETZEL, Grönland geograph. und statist. beschrieben, 1860, p. 600.
Sertularia polyzonias GREEN, Manual Anim. King., II, Cœlenterata, 1861, p. 95.
Sertularia polyzonias HINCKS, Ann. and Mag., 3d ser., VIII, 1861, p. 252.
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Sertularia polyzonias Norman, Report Brit. Assoc., 36th meeting, 1867, p. 200.
Sertularia ellisii Norman, Report Brit. Assoc., 36th meeting, 1867, p. 200.
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Sertularella polyzonias McIntosh, Ann. and Mag., 4th ser., XIII, 1874, p. 212.
Sertularella polyzonias Schulze, Nordsee Exped., 1874, p. 131.
Sertularella polyzonias Verrill, Am. Journ. Sci., VII, 1874, pp. 39, 504.
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Sertularella polyzonias Norman, Ann. and Mag., 4th ser., XV, 1875, p. 173.
Sertularella polyzonias Smith and Harger, Trans. Conn. Acad., III, 1876, p. 21.
Sertularella polyzonias Clark, Alaskan Hydroids, 1876, p. 224.
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Sertularella polyzonias Allman, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 21.
Sertularella polyzonias Mereschkowsky, Ann. and Mag., 5th ser., I, 1878, p. 331.
Sertularella polyzonias Norman, Ann. and Mag., 5th ser., I, 1878, p. 190.
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Sertularella polyzonias Weismann, Entstehung der Sexualzellen, 1883, p. 165.
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Sertularella polyzonias Melly, Report Fauna Liverpool Bay, 1886, p. 108.
Sertularella polyzonias Lendenfeld, Descript. Cat. Austral. Hydromedusæ, II, 1887, p. 19.
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Sertularella implexa Allman, Challenger Report, Hydroida, Pt. 2, 1888, p. 54.
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Sertularella polyzonias Segerstedt, Bih. Svenska vet. Akad. Zool., XIII, 1889, p. 16.
Sertularella polyzonias Bourne, Journ. Marine Biol. Assoc., 1890, p. 396.
Sertularella polyzonias Marktanner-Turneretscher, Hydroiden aus dem k. k. naturh. Hofmuseums, 1890, p. 224.
Sertularella polyzonias Fewkes, Bull. Essex Inst., XXIII, 1891, p. 38.
Sertularella polyzonias Holt, Proc. Royal Dublin Soc., VII, 1892, p. 251.
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Sertularella polyzonias Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1892, p. 58.
Sertularella polyzonias Levinsen, Vid. Udb. "Hauchs" Togter, 1893, p. 388.
Sertularella polyzonias Möbius, Sitz. Ber. Ak. Berlin, 1893, p. 86.
Sertularia polyzonias Duerden, Proc. Royal Irish Acad, 3d ser., III, 1893, p. 145.
Sertularella polyzonias Hartlaub, Die Coelenteraten Helgolands, Wiss. Meeresunt., 1894, p. 179.
Sertularella polyzonias Thornely, Trans. Liverpool Biol. Soc., VIII, 1894.
Sertularella polyzonias Crawford, Ann. and Mag., 6th ser., XIV, 1895, p. 261.
Sertularella polyzonias Farquhar, Trans. New Zealand Inst., XXVIII, 1896, p. 463.
Sertularella polyzonias Roule, Resultats sc. Campagne du Caudan, II, 1896, pp. 301, 733.
Sertularella polyzonias Hartlaub, Hydromedusen Helgolands, Wis. Meeresuntersuchungen, new ser., I, 1897, p. 451.
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Sertularella polyzonias Duerden, Proc. Dublin Soc., new ser., VIII, 1897, p. 416.
Sertularella polyzonias Schneider, Zool. Jahrb., X, System., 1898, p. 483.
Sertularella polyzonias Hilgendorf, Trans. New Zealand Inst., XXX, 1898, p. 210.
Sertularella polyzonias Bonnevie, Norwegian North Atl. Exped., 1899, p. 78.

Sertularella polyzonias ALLEN, Journ. Marine Biol. Assoc., V, 1899, p. 453.
Sertularella polyzonias LO BIANCO, Mt. Sta. Neapel, XIII, 1899, p. 461.
Sertularella polyzonias BETENCOURT, Travaux Stat. Zool. Wimereux, VII, 1899, p. 10.
Sertularella polyzonias HARTLAUB, Wiss. Meeresunt., III, Helgoland, 1899, p. 115.
Sertularella polyzonias RADDE, Samml. Kauk. Mus. Tiflis, 1899, p. 517.
Sertularella polyzonias PICTET and BEDOT, Hydraires de l'Hirondelle, 1900, p. 22.
Sertularella polyzonias HARTLAUB, Revision Sertularella-Arten, 1900, p. 88.
Sertularella polyzonias NUTTING, Hydroids of Woods Hole Region, 1901, p. 362.
Sertularella polyzonias NUTTING, Hydroids Harriman Exped., 1901, p. 183.
Sertularella polyzonias WHITEAVES, Cat. Marine Invert. Eastern Canada, 1901, p. 25.
Sertularella polyzonias SÆMUNDSSON, Bidrag til Kundskaben islandske Hydroider, 1902, p. 67.

Trophosome.—Colony of exceedingly irregular growth, attaining a height of 4 or 5 inches. Stem not fascicled, slender, flexuose, irregularly branched; nodes very distant and irregular. Branches irregularly alternate, flexuose, themselves often branching profusely, divided into irregular internodes, the tendency being to have an internode to each hydrotheca. Hydrothecæ rather distant, stout; proximal portion somewhat swollen, about the distal half free and with approximately parallel sides; aperture square, margin with four low equidistant teeth; operculum of four flaps.

Gonosome.—Gonangia ovate, with four conspicuous horn-like projections around the margin and very deeply rugose throughout, those of the female being much larger than those of the male colonies. When the sexual elements are mature the gonangia are surmounted by globular acrocysts, within which the ova develop into planulæ.

Distribution.—One of the most abundant and widely distributed of the hydroids. New England coasts (Verrill), Bay of Fundy (Stimpson), Gulf of St. Lawrence (Dawson), Alaska (Clark), Strait of Magellan (Hartlaub), Chile (Hartlaub), Greenland (Levinsen), Norway (Sars), Denmark (Winther), Shetland (Norman), Iceland (Sæmundsson), Great Britain (Hincks), Helgoland (Hartlaub), Mediterranean (Lo Bianco), Adriatic (Pieper), Azores (Bedot), Australia (Bale), Cape of Good Hope (Johnston), Red Sea (Kirchenpauer). *Albatross* Station 2669, lat. N. 31° 09′, ong. W. 79° 33′ 30″, 353 fathoms; Station 2699, lat. N. 45° 04′, long. W. 55° 23′, 72 fathoms; Station 3294, lat. N. 57° 16′ 45″, long. W. 159° 03′ 30″, 30 fathoms; Station 3505, lat. N. 57° 09′, long. W. 168° 17′, 44 fathoms; Station 3511, lat. N. 57° 32′, long. W. 169° 38′, 39 fathoms.

This species has frequently been mistaken for *S. gayi.* It can be distinguished from that species, however, by the fact that it has a nonfascicled stem, a smooth hydrotheca, and stouter gonangia which have four teeth instead of two.

SERTULARELLA CLAUSA (Allman).

(Plate XXI, figs. 3, 4.)

Sertularia clausa ALLMAN, Challenger report, Hydroida, Pt. 2, 1888, p. 54.
Sertularella clausa HARTLAUB, Revision der Sertularella-Arten, 1900, p. 99.

Trophosome.—Colony attaining a height of about 1 inch. Stem not fascicled, delicate, sinuous, divided into regular internodes, each of which bears a hydrotheca. Branches irregular, with a tendency to an alternate arrangement, themselves sometimes dichotomously branched, internodes slender and rather long.

Hydrothecæ rather distant, swollen below, exserted throughout their distal half, narrowing gradually to the margin; margin with four very shallow teeth and with a strong four-flapped operculum, which forms a low pyramid above the hydrothecal aperture.

Gonosome.—Not known.

Distribution.—Off Montevideo, lat. S. 37° 17′, long. W. 53° 32′, 600 fathoms.

The above description and the figures of this species were taken from a part of Allman's type specimen, kindly sent me by the authorities of the South Kensington Museum. The depth at which this species was found is exceptional for the genus. The very strong operculum is a feature that one would not expect to find associated with such inconspicuous hydrothecal teeth.

Type.—In South Kensington Museum, London. A fragment in the collection of the author.

SERTULARELLA COMPLEXA, new species.

(Plate XXI, figs. 5–9.)

Trophosome.—Colony attaining a height of about 3 inches, exceedingly straggling in habit, the stem and branches being very long and slender, the latter often anastomosing, forming a rude mesh, in which the stem and branches are hardly distinguishable from each other. Stem slightly flexuose in places, divided into regular short internodes, each with a single hydrotheca, or in other places with nodes not perceptible. Branches growing at right angles with the stem, themselves branched irregularly, often the terminal branches being dichotomous, the distal ends of branches often anastomosing firmly with other branches.

Hydrothecæ fairly distant, quite short, about the distal third free, and much constricted by the leveling off of the adcauline side; margin with four rather low equidistant teeth; operculum four-flapped.

Gonosome.—Gonangia borne in rows along the stem and branches, small, regularly oval, with broad, even annulations over the entire surface; aperture round, not elevated on a neck, and surrounded at some distance by a series of from three to seven blunt tooth-like points.

Distribution.—*Albatross* Station 2843, lat. N. 53° 56′, long. W. 165° 56′, 45 fathoms; Station 2853, lat. N. 56°, long. W. 154° 20′, 159 fathoms; Station 2858, lat. N. 58° 17′, long. W. 148° 36′, 230 fathoms; Station 3500, lat. N. 56° 02′, long. W. 169° 30′, 121 fathoms.

This species occurred quite abundantly in the U. S. Fish Commission steamer *Albatross* dredgings off the Alaskan coast. At first sight it greatly resembles in mode of branching, shape of hydrothecæ, etc., *S. dichotoma*, but the four hydrothecal teeth, and particularly the unusual structure surrounding the mouth of the gonangia, render it, in my opinion, a distinct species.

Type slides.—Cat. No. 19745, U.S.N.M. Cat. No. 18696, Museum State University of Iowa; also in collection of the author.

SERTULARELLA PINNATA Clark.

(Plate XXI, figs. 10–12.)

Sertularella pinnata CLARK, Alaskan Hydroids, 1876, p. 226.
Sertularella pinnata MERESCHKOWSKY, Ann. and Mag., 5th ser., II, 1878, p. 450.
Sertularella fruticulosa KIRCHENPAUER, Nordische Gattungen, 1884, p. 50.
? *Sertularella pinnata* LORENZ, Internat. Polarforsch. Jan Mayen, 1886, III, p. 2.
? *Sertularella pinnata* MARKTANNER-TURNERETSCHER, Hydroiden aus den k. k. naturh. Hofmuseums, 1890, p. 223.
Sertularella pinnata HARTLAUB, Revision der Sertularella-Arten, 1900, p. 40.

Trophosome.—Colonies growing in dense clumps, sometimes attaining a height of about 1 inch. Stem not fascicled, divided into regular short internodes each of which bears a branch and an axillary hydrotheca. Branches alternate, divided into regular internodes which are very short, each bearing a hydrotheca on a very broad shoulder on the internodes, the nodes being opposite the middle of the hydrothecæ, often branching dichotomously; branches themselves often branching dichotomously, nodes very deeply cut, giving sharp constrictions of the thick perisarc. Hydrothecæ inclined forward and outward, appearing in front view to be borne on the front of the branches, very closely approximated, short, stout, the distal half free; margin greatly and abruptly expanded and rimmed, with three very large pointed teeth, the two outermost being the larger; an intrathecal ridge extends horizontally from a constriction in the outer wall around the inside of the hydrotheca to about the middle of the side wall. The floor of the hydrotheca is of very thick chitin with a pointed process extending downward from the posterior lateral corners.

Gonosome.—Gonangia borne in double rows on the front of the main stem and branches, large, broadly ovate, exceedingly rugose, the rugosities not being even and parallel, as in other species, but sinuous, giving a peculiar appearance of distortion; aperture broad, round, not mounted on a collar.

Distribution.—Unalaska, Coal Harbor, Shumagin Islands, Lituya Bay, 112 fathoms (Clark).

This species excels all others that I have seen in a general appearance of rugosity, the chitinous periderm being very thick and much wrinkled.

The present writer agrees with Hartlaub in regarding *S. fruticulosa* Kirchenpauer as a synonym of *S. pinnata* Clark.

Type.—In the collection of the U. S. National Museum.

SERTULARELLA MARGARITACEA Allman.

(Plate XXII, fig. 1.)

Sertularella margaritacea ALLMAN, Linn. Soc. Journ., Zool., XIX, 1885, p. 133.
Sertularella margaritacea HARTLAUB, Revision der Sertularella-Arten, 1900, p. 50.

"*Trophosome.*—Stem monosiphonic, much branched. Hydrothecæ distant, adnate by about half their height to the stem, from which they then become strongly divergent, epicauline side ventricose toward the base; orifice with a thickened rim and with a deep sinus at its apocauline side.

"*Gonosome.*—Gonangia springing from the angles of the ramification, ovoid, marked by wide transverse rugæ toward the summit and base.

"*Locality.*—Straits of Magellan. On an air vescicle of *Macrocystis pyrifera*."

I have not seen this species, and have copied the above description entire from that of the original describer. The figure would seem to indicate that there were three hydrothecal teeth, although their number is not given in the description. The form bears considerable resemblance to that of *S. dichotoma*, which came from the same region and is apparently a very variable species, so far as the trophosome is concerned. The gonangia, however, are quite different.

Type.—In the collection of Miss H. Gatty.

SERTULARELLA TURGIDA (Trask).

(Plate XXII, figs. 2–5.)

Sertularia turgida TRASK, Proc. Cal. Acad. Nat. Sci., 1857, p. 113.
Sertularia turgida A. AGASSIZ, North American Acalephæ, 1865, p. 145.
Sertularella turgida CLARK, Hydroids of the Pacific Coast, 1876, p. 259.
Sertularella turgida KIRCHENPAUER, Nordische Gattungen, 1884, p. 51.
Sertularella conica CALKINS, Hydroids from Puget Sound, 1899, p. 359.
Sertularella nodulosa CALKINS, Hydroids from Puget Sound, 1899, p. 360.
Sertularella turgida HARTLAUB, Revision der Sertularella-Arten, 1900, p. 67.
Sertularella turgida HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 360.
Sertularella turgida TORREY, Hydroida of the Pacific Coast, 1902, p. 64.

Trophosome.—Colony small, sometimes consisting of an unbranched stem, attaining a height of about 1 inch in specimens examined. Stem geniculate, divided into regular short internodes, each of which bears a hydrotheca. Branches, when present, not regularly arranged, few in number, and resembling the main stem in all respects. Hydrothecæ closely approximated, rather large, stout, subcylindrical, the ends being slightly constricted; aperture large, margin with three unequally developed teeth, the two outer ones being very strong and equal, the other smaller. As a rule less than the distal half of the hydrotheca is free.

Gonosome.—Gonangia borne in the axils of the hydrothecæ, large, obovate, terminating in a small inconspicuous aperture at the summit of a short collar, and with the distal portions armed with a number of blunt spines, these being much more numerous in some specimens than in others. There is also a sort of dimorphism in size which probably corresponds to sex, the larger gonangia being female.

Distribution.—Bay of San Francisco, Monterey, Tomales Point, California (Trask); San Diego, California (D. C. Cleveland); Vancouver Island, J. M. Dawson (Clark); Townsend Harbor (Calkins); Oregon (Nutting); *Albatross* Station 2861, lat. N. 54° 14′, long. W. 129° 50′, 204 fathoms. *Albatross* Station (Hydrographic) 3775, off Japan, 57 fathoms.

I agree with Hartlaub in the opinion that the *S. nodulosa* of Calkins is really identical with the present species. The specimen from Japan is more branched and the hydrothecæ more distant and more exserted than in other specimens that I have examined.

SERTULARELLA SIEBOLDI Kirchenpauer.

(Plate XXII, figs. 6–7.)

Sertularella sieboldi KIRCHENPAUER, Nordische Gattungen, 1884, p. 49.
Sertularella sieboldi HARTLAUB, Revision der Sertularella-Arten, 1900, p. 69.

Trophosome.—Colony small, branches profuse and irregular. Stem not thicker than the branches, slender, gnarled, twisted, and annulated, those internodes bearing branches being generally separated by internodes without branches. Branches partly quite regular and partly irregular, springing from the sides of hydrothecæ. Hydrothecæ arise from the flexures of the stem, sometimes closely approximated, sometimes distant, very irregular, pitcher-shaped, swollen, with slender necks and three-toothed apertures.

Gonosome.—Gonangia oval, deeply annulated above and below. Aperture with three teeth; neck slender.

Distribution.—Cuba.

In the absence of specimens the above description was compiled by combining points given by Kirchenpauer and by Hartlaub, who studied the type specimen.

Kirchenpauer's drawings are evidently from dried specimens, or else the annulations, etc., are greatly exaggerated, as claimed by Hartlaub. At any rate, no one would suppose that the drawings given by these two authors were from the same species, much less the same type specimen.

Type.—In museum at Leipsic.

SERTULARELLA SUBDICHOTOMA Kirchenpauer.

(Plate XXII, figs. 8–12.)

Sertularella subdichotoma KIRCHENPAUER, Nordische Gattungen, 1884, p. 46.
Sertularella subdichotoma BALE, Trans. Royal Soc. Victoria, 1887, p. 107.
Sertularella subdichotoma HARTLAUB, Revision der Sertularella-Arten, 1900, p. 33.

Trophosome.—Colony exceedingly straggling and irregular in growth, sometimes attaining a height of about 2 inches. Stem not fascicled, branching dichotomously, but in a very loose and straggling manner. Stem and branches not divided into regular internodes in the proximal portions, but distally divided into long slender internodes, each of which bears a hydrotheca. Hydrothecæ small, varying greatly in shape, usually rather distant, short, attached for more than two-thirds their adcauline side, the free portion being abruptly narrowed; margin usually with three broad equal and equidistant teeth; operculum of three flaps. There is often an oblique or horizontal intrathecal ridge.

Gonosome.—Gonangia slender, ovoid, annulated rather feebly, with a distal flange-like outer collar and a slender neck ending in a round aperture. In some cases there is no outer collar nor inner neck, but a broad, round terminal aperture as figured by Kirchenpauer.[1]

Distribution.—Bass Straits, Australia (Kirchenpauer); Straits of Magellan (Kirchenpauer); Patagonia (Hartlaub); *Albatross* Station 2776, lat. S. 52° 41′, long. W. 69° 55′ 30″, 21 fathoms.

This appears to be an exceedingly variable species in almost every detail of its structure. Specimens from Station 2776 agree well with one sent me by Professor Levinsen from the Straits of Magellan. The gonosome, as well as other parts, is very variable, and some of the gonangia resemble Kirchenpauer's figure, and others the original figure of d'Orbigny for *S. milneana.*[2]

Type.—In the Berlin Museum.

[1] Nordische Gattungen und Arten, 1884, pl. XVI, fig. 1, *b*.
[2] Voyage dans l'Amérique Méridionale, 1839, p. 26, pl. XI, fig. 8.

SERTULARELLA FILIFORMIS (Allman).

(Plate XXIII, figs. 1–3.)

Sertularia filiformis ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, pl. XXIV, fig. 1.
Sertularia gracilis ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 51.
Sertularella filiformis HARTLAUB, Revision der Sertularella-Arten, 1900, p. 23.

Trophosome.—Colony of graceful and delicate texture, attaining a height of 5 inches. Stem not fascicled, slender, flexuose, divided into irregular internodes. Branches not flexuose, alternate, themselves often branching like the main stem in an alternate manner, and sometimes these branches again divide; internodes irregular, each bearing a hydrotheca or a hydrotheca and branchlet on distal portions of colony, while the nodes are generally lacking on proximal parts. Hydrothecæ tubular, gracefully and regularly curved outward, with about their distal third free, and an oblique intrathecal ridge; margin with three well-defined teeth, and an operculum composed of three parts.

Gonosome.—Gonangia borne on the stem and branches in all their ramifications, elongate-oval, with rather long curved pedicels, and a series of very deep compressed annular ridges extending much beyond the general surface, like a series of superimposed dinner plates, the uppermost being bowl-shaped, and giving origin at its center to a long, slender, tubular neck, which is slightly expanded at both ends. Aperture small.

Distribution.—Port Famine, Patagonia, lat. S. 53° 37′, long. W. 70° 56′, 9 fathoms. (Allman.)

The above description is from a portion of Allman's type, which differs from the original description in having three well-marked hydrothecal teeth, instead of two. The species is evidently allied closely to *S. tricuspidata*, but differs in the shape of the hydrothecæ and gonangia.

Type.—In South Kensington Museum, London; also in collection of author.

SERTULARELLA QUADRIFIDA Hartlaub.

(Plate XXIII, figs. 4–7.)

Thuiaria quadridens ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 66.
?*Sertularella affinis* HARTLAUB, Revision der Sertularella-Arten, 1900, p. 43.
Sertularella quadrifida, new name, HARTLAUB, Revision der Sertularella-Arten, 1900, p. 120.

Trophosome.—Colony attaining a height of about 2 inches. Stem not fascicled, flexuose, divided into regular internodes, each of which bears a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches regularly alternate, themselves often branching dichotomously, internodes very long, the nodes often being entirely wanting. Hydrothecæ rather distant, small, adnate to the branch by more than half their adcauline side, the free portion forming an acute angle with the branch; margin with three teeth, instead of four, although an appearance of four teeth is sometimes produced by a reduplication of the margin on the adcauline side, which reduplicates the single adcauline tooth; operculum of three flaps.

Gonosome.—Not known.

Distribution.—Between Cape Virgin and Falkland Islands, lat. S. 51° 35′, long. W. 65° 39′, 70 fathoms.

The above description is taken from Allman's type collected by the *Challenger*. Of course the presence of three instead of four teeth renders the name *quadrifida* misleading, but it seems preferable to preserve the name even at the expense of incongruity.

Hartlaub finds that the name originally given to this species by Allman was preoccupied by Bale in 1884.[1]

Type.—In South Kensington Museum. Fragment in possession of the author.

[1] Catalogue of Australian Hydroid Zoophytes, Sydney, 1884, p. 119.

SERTULARELLA MERIDIONALIS, new species.

(Plate XXIII, figs. 8–9.)

Trophosome.—Colony compactly pinnate in shape, attaining a height of about 2 inches. Stem not fascicled, flexuose, proximal portion not differing from the rest, not noticeably annulated, divided into fairly regular internodes by oblique nodes, each internode often bearing a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches regularly alternate, rather closely approximated, constricted sharply at their origins, divided into long and irregular internodes. Hydrothecæ large, closely approximated, tubular, with both proximal and distal ends expanded, both lower and upper profiles concave; about one-half of the adcauline wall free; margin expanding, with three strongly developed teeth, and a three-flapped operculum.

Gonosome.—Gonangia quite large, oblong-conical, the distal portion being ornamented with three to five, usually three, pronounced annular turrets; neck small, tubular, suddenly expanding distally into a trumpet-shaped termination with a round orifice.

Distribution.—*Albatross* Station 2783, lat. S. 51° 02′ 30″, long. W. 74° 08′ 30″, 122 fathoms.

This very striking species bears considerable resemblance to *S. milneana*, but has fewer annulations and a more suddenly enlarged termination to the neck of the gonangia. The trophosome is very much more compact and robust than that of *S. milneana*, and the hydrothecæ are quite different in shape.

Type slides.—Cat. No. 19767, U.S.N.M.; Cat. No. 18709, Museum of State University of Iowa; also in collection of the author.

SERTULARELLA ELEGANS, new species.

(Plate XXIV, fig. 1.)

Trophosome.—Colony growing from a root stalk parasitic on *Abietinaria*, and attaining a height of about 3 inches. Stem not fascicled, with several strong annulations on proximal portion, divided into regular internodes, each bearing a hydrotheca, which is directed forward, outward, and upward; nodes very strong and deeply cut. Branches straggling and irregular, tending to an alternate arrangement, and sometimes anastomosing as in *S. johnstoni*, divided by deeply incised nodes into rather short, regular internodes, each of which bears a hydrotheca. Hydrothecæ directed forward, outward, and upward, rather closely approximated, tubular, gently curved, adherent by about their proximal adcauline third; margin expanding, with three strong and equidistant teeth, and with a narrow border or rim; operculum of three flaps. Hydrothecæ often with an oblique intrathecal ridge running downward from the anterior margin.

Gonosome.—Gonangia in rows on stem and main branches, exceedingly elaborate in ornamentation, oval to round, neck tubular with trumpet-shaped aperture, the usual annulations produced into raised fluted frills that look like a series of lace collars, giving an exceedingly ornate effect.

Distribution.—*Albatross* Station 2842, lat. N. 54° 15′, long. W. 166° 03′, 72 fathoms.

At first view this species bears a general resemblance to *S. tricuspidata*, but the hydrothecæ lie in two planes, are more crowded and heavier, and the gonangia carry ornamentation to its greatest length as found in the genus.

Type slides.—Cat. No. 19752, 19753, U.S.N.M.; Cat. No. 18701, Museum State University of Iowa; also in the collection of the author.

SERTULARELLA MILNEANA (d'Orbigny).

(Plate XXIV, figs. 2–5.)

Sertularia milneana D'ORBIGNY, Voyage l'Amérique Méridionale, V, 1839, p. 26.
Sertularella milneana KIRCHENPAUER, Nordische Gattungen, 1884, p. 52.
Sertularella milneana HARTLAUB, Revision der Sertularella-Arten, 1900, p. 39.

Trophosome.—Colony very striking in habit, attaining a height of about 4 inches. Stem proximally without hydrothecæ, slender and with numerous annulations, remainder very slightly

flexose with distant nodes. Branches irregularly alternate, themselves branching dichotomously, with exceedingly distant nodes. Hydrothecæ closely approximated, tubular, gradually bending outward, extent of immersion varying greatly, almost the entire adcauline wall being sometimes adnate to the hydrocaulus, and at other times the distal half is free, every intergradation between these extremes sometimes being found in one colony, margin with three well-marked and equidistant teeth and a three-flapped operculum.

Gonosome.—Gonangia large, borne on all parts of the colony, sometimes aggregated on distal portions, oblong-ovate, distal third ornamented with six to eight even annular rugosities, remainder perfectly smooth; aperture small, at the summit of a small tubular neck with a slight distal expansion.

Distribution.—Southern coast of Patagonia, Ross Bay, south of Rio Negro (d'Orbigny). *Albatross* Station 2776, lat. S. 52° 41′, long. W. 69° 55′ 30″, 21 fathoms; Station 2777, lat. S. 52° 38′, long. W. 70° 10′ 30″, 19.75 fathoms.

The very characteristic gonangia with smooth walls, save for a few distal annulations, seems to me to serve at once for the identification of this species. Specimens collected by the U. S. Fish Commission steamer *Albatross* agree very well with d'Orbigny's figures and descriptions.

SERTULARELLA MAGELLANICA (Marktanner-Turneretscher).

(Plate XXIV, figs. 6–8.)

Calyptothuiaria magellanica Marktanner-Turneretscher, Hydroiden aus den k. k. naturhist. Hofmuseums, 1900, p. 244.
Sertularella magellanica Hartlaub, Revision der Sertularella-Arten, 1900, p. 22.

Trophosome.—Colony attaining a height of about 2 inches in largest specimen examined. Stem not fascicled, with several deep annulations on its proximal nonhydrothecate part, basal portion tubular, broadening and flattening distally. Branches somewhat irregular, but tending to an alternate arrangement, narrow at their origin, almost straight, internodes long and irregular. Hydrothecæ alternate, large, tubular, gentle curving throughout their length; differing greatly in the extent of their immersion, some on the distal parts of the colony having not more than their distal third free, while some near the base of the main stem are free throughout their entire length; margin with three large equal and equidistant teeth. Operculum with three flaps.

Gonosome.—Unknown.

Distribution.—Straits of Magellan (Marktanner-Turneretscher); *Albatross* Station 2771, lat. S. 51° 34′, long. W. 68°, depth 50.5 fathoms.

This species is remarkable in reversing the ordinary condition of affairs among sertularians in two particulars: first, the stem widens distally; second, the proximal hydrothecæ tend to be more exserted than the distal.

Type.—In k. k. naturhistorischen Hofmuseums, Vienna.

SERTULARELLA MINUTA, new species.

(Plate XXIV, figs. 9–10.)

Trophosome.—Colony exceedingly fragile and delicate, attaining a height of about one-half inch. Stem not fascicled, strongly geniculate, divided into regular long internodes. Branches very irregular, often forming a right angle with the stem, branching dichotomously, slender, very strongly geniculate, divided into regular long internodes each of which bears a hydrotheca near its distal end. Hydrothecæ distant, actually small but large in proportion to the diameter of the stem and branches, slender, almost tubular, bending gently outward, almost completely exserted but a small portion of the adcauline wall being adnate to the branch, margin with three teeth; operculum with three flaps.

Gonosome.—Gonangia borne on stem and main branches, small, ovoid, strongly and evenly annulated throughout, with a short tubular neck and slightly expanded aperture.

Distribution.—*Albatross* Station 3480, lat. N. 52° 06′, long. W. 171° 45′, 283 fathoms.

This exceedingly delicate and beautiful species seems to be quite distinct. In some respects it resembles a miniature of *S. tricuspidata*, and in others a miniature of *S. tropica*. It differs

from both, however, in its very long internodes, from the former in the degree of exsertion of its hydrothecæ, and from the latter in the form and ornamentation of the gonangia.

Type slides.—Cat. Nos. 19,771, 19,772, U. S. N. M.; Cat. No. 18,711, Museum State University of Iowa; also in the collection of the author.

SERTULARELLA LEVINSENI, new species.

(Plate XXVI, figs. 1–2.)

Trophosome.—Colony very loose and straggling in habit, sometimes attaining a height of 3 inches. Stem not fascicled, slender, flexuose, divided into regular internodes each of which bears a hydrotheca or a hydrotheca and branch. Branches irregularly alternate, slender, flexuose, often dividing dichotomously, rarely anastomosing, divided into regular internodes throughout. Hydrothecæ rather small and distant, stout, swollen below, their adcauline wall adnate for from one-half to three fourths its length; margin with three well-marked equal and equidistant teeth; operculum with three flaps.

Gonosome.—Gonangia borne in rows on stem and all the branches, although they are more apt to be aggregated proximally, small, ovoid, somewhat elongate, with shallow broad annulations particularly on distal portions; neck short but distinct.

Distribution.—*Albatross* Station 2842, lat. N. 54° 15′, long. W. 166° 03′, 72 fathoms.

This species is allied to *S. dichotoma* in the general appearance of its trophosome, but differs in having more distant and much larger hydrothecæ, a complete division of stem into regular internodes, and a different gonosome. It is allied to *S. tropica* Hartlaub in the shape of its gonangia, but differs in having smaller hydrothecæ which are much more exserted, and gonangia not nearly so slender.

I take pleasure in naming this species in honor of Professor G. M. R. Levinsen, whose valuable papers on the hydroids of northern waters have greatly extended our knowledge.

Type slides.—Cat. No. 19,761, U. S. N. M.; Cat. No. 18,706, Museum State University of Iowa; also in collection of the author.

SERTULARELLA DENTIFERA Torrey.

(Plate XXV, figs. 1-2.)

Sertularella dentifera Torrey, Hydroida of the Pacific Coast, 1902, p. 61.

"*Trophosome.*—Stem slender, flexuose, branched. Branches arising within or in place of hydrothecæ; similar to stem. Hydrothecæ free for three-quarters of their length, tubular, slightly enlarged at base; margin reduplicated, furnished with three moderate teeth forming a triangle with apex nearest stem."

Gonosome.—Not known.

Distribution.—San Pedro, California.

I have not seen this species, and have copied the original description entire, although there is considerable likelihood that it is identical with *S. tropica* Hartlaub.[1] The character given by Torrey, as, "branches arising within or in place of hydrothecæ" occurs as a sort of abnormality in numerous species of hydroids that normally branch in the ordinary manner, and it is of doubtful value as a means of distinguishing species.

Type.—In the collection of the University of California.

SERTULARELLA TRICUSPIDATA (Alder).

(Plate XXV, figs. 3–7.)

Sertularia tricuspidata Alder, Ann. and Mag., 2d ser., XVIII, 1856, p. 356.
Sertularia tricuspidata Alder, Cat. Zooph. Northumb, 1857, p. 21.
Sertularia ericoides Mörch, Rink. Grönland geograph. og statisk beskr., 1857, p. 97.
Sertularia tricuspidata Greene, Ann. and Mag., 3d ser., V, 1860, p. 431.

[1] See Clarke's description and figures of *S. variabilis* (=*S. tropica* Hartlaub), Bulletin of the Museum of Comparative Zoology, XXV, 1894, p. 75, pl. iv, fig. 20, and pl. v, figs. 21 and 22.

Sertularia tricuspidata Alder, Trans. Tyneside Field Club, V, 1862, p. 289.
Sertularia tricuspidata Packard, Canadian Naturalist, 1863, p. 4.
Cotulina tricuspidata A. Agassiz, North. Amer. Acalephæ, 1865, p. 146.
Sertularella tricuspidata Hincks, Brit. Hydroid Zooph., 1868, p. 239.
Sertularella tricuspidata Verrill, Proc. Am. Assn. Adv. Sci., 1873, pp. 353, 359, 364.
Sertularella tricuspidata Kirchenpauer, Zweite deutsche Nordpolarfahrt, 1869–70, II, 1874, p. 416.
Sertularella tricuspidata Hincks, Ann. and Mag., 4th ser., XIII, 1874, p. 151.
Sertularella tricuspidata Verrill, Am. Jour. Sci. and Arts, VII, 1874, p. 44.
Sertularella tricuspidata Lütken, Arctic Manual, 1875, p. 190.
Sertularella tricuspidata Clark, Alaskan Hydroids, 1876, p. 224.
Sertularella tricuspidata Smith and Harger, Trans. Conn. Acad., III, 1876, p. 7.
Sertularella tricuspidata Hincks, Ann. and Mag., 4th ser., XX, 1877, p. 67.
Sertularella tricuspidata Norman, Ann. and Mag., 5th ser., I, 1878, p. 190.
Sertularella tricuspidata Mereschkowsky, Ann. and Mag., 5th ser., I, 1878, p. 323.
Sertularella tricuspidata D'Urban, Ann. and Mag., 5th ser., VI, 1880, p. 268.
Sertularella tricuspidata Winther, Naturh. Tidsskr., (3), XII, 1880, p. 276.
Sertularella tricuspidata Ridley, Ann. and Mag., 5th ser., VII, 1881, p. 455.
Sertularella tricuspidata Rathbun, Proc. U. S. Nat. Mus., 1883, p. 216.
Sertularella tricuspidata Thompson, Bijdragen to de Dierkunde, Afl. X, 1884, p. 6.
Sertularella tricuspidata Kirchenpauer, Nordische Gattungen, 1884, p. 45.
Sertularella pallida Kirchenpauer, Nordische Gattungen, 1884, p. 48.
Sertularella tricuspidata Murdoch, Polar Exped. Point Barrow, 1885, p. 166.
Sertularella tricuspidata Lorenz, Die intern. Polarforschung, Jan Mayen, III, 1886, p. 2.
Sertularella tricuspidata Thompson, Vega Expedition, Vet. Jacktag., IV, 1887, p. 394.
Sertularella tricuspidata Bergh, Goplepolyper fra Kara Havet, 1887, p. 335.
Sertularella tricuspidata Marktanner-Turneretscher, Hydroiden aus den k. k. naturhist. Hofmuseums, 1890, p. 222.
Sertularella tricuspidata Fewkes, Bull. Essex Inst., XXIII, 1891, p. 88.
Sertularella tricuspidata Levinsen, Vid. Meddel. naturh. Foren., 1892, p. 59.
Sertularella tricuspidata Marktanner-Turneretscher, Hydroiden von ost Spitzb., 1895, p. 425.
Sertularella tricuspidata Jaderholm, Bihang svensk. Akad., XXI, 1896, p. 12.
Sertularella tricuspidata Roule, Köhler, Résultats sc. Campagne du Caudan, Pt. 2, 1896, p. 301.
Sertularella tricuspidata Pedaschenko, Trav. Soc. Nat. St. Petersbourg, XXVIII, 1897, p. 226.
Sertularella tricuspidata Sinizin, Arb. Zool. Inst. Warschau, 1898, p. 228.
Sertularella tricuspidata Birula, Ann. Mus. Petersbourg, 1898, p. 203.
Sertularella tricuspidata v. Adelung, Zool. Centralblatt, 1899, p. 518.
Sertularella tricuspidata Nutting, Hydroids from Alaska and Puget Sound, 1899, p. 741.
Sertularella tricuspidata Bonnevie, Norwegian North Atl. Exped., 1899, p. 78.
Sertularella tricuspidata Calkins, Hydroids from Puget Sound, 1899, p. 360.
Sertularella tricuspidata Pictet and Bedot, Hydraires de l'Hirondelle, 1900, p. 222.
Sertularella tricuspidata Hartlaub, Revision der Sertularella-Arten, 1900, p. 23.
Sertularella tricuspidata Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 354.
Sertularella tricuspidata Nutting, Hydroids of the Woods Hole Region, 1901, p. 362.
Sertularella tricuspidata Nutting, Harriman Expedition, the Hydroids, 1901, p. 183.
Sertularella tricuspidata Hargitt, Amer. Naturalist, 1901, p. 391.
Sertularella tricuspidata Whiteaves, Cat. Marine Invert. Eastern Canada, 1901, p. 26.
Sertularella tricuspidata Sæmundsson, Bidrag til Kundskaben islandske Hydroider, 1902, p. 68.
Sertularella hesperia Torrey, Hydroida of the Pacific coast, 1902, p. 63.

Trophosome.—Colony a matted mass of shoots and twigs sometimes attaining a height of 5 or 6 inches. Stem not fascicled, slender, divided into internodes each of which bears a hydrotheca or a branch with its axillary hydrotheca. Branches irregularly alternate, often branching profusely either alternately or dichotomously, divided into regular internodes each of which bears a hydrotheca, some of the nodes being double and oblique, which gives a twisted appearance to the branch. Hydrothecæ distant, small, cylindrical, without corrugations, the distal half or more being free; margin with three strong, equal and equidistant teeth; operculum composed of four flaps.

Gonosome.—Gonangia borne profusely on the main stem and branches, large, oblong-ovate, marked throughout with very prominent compressed annular ridges, the uppermost of which forms a bowl-shaped structure from the center of which arises the tubular neck which ends in a slightly everted margin and round aperture.

Distribution.—Abundant throughout the north polar and north temperate regions of the world. New England coast (Verrill); Gulf of St. Lawrence (Dawson); Labrador (Packard);

Alaska (Clark); Aleutian Islands (Clark); St. Pauls Island (Clark); Puget Sound (Nutting); Port Townsend (Calkins); San Diego Harbor (Torrey); Greenland (Winther); Polar Sea (Bergh); Iceland (Hincks); Spitzbergen and North Cape (Bonnevie); British Islands (Hincks); Gulf of Gascony (Bedot); *Albatross* Station 2557, lat. N. 39° 53′ 10″, long. W. 71° 31′, 154 fathoms; Station 2850, lat. N. 54° 52′, long. W. 159° 46′, 21 fathoms; Station 2857, lat. N. 58° 05′, long. W. 150° 46′, 51 fathoms; Station 2858, lat. N. 58° 17, long. W. 148° 36′, 230 fathoms; Station 2865, lat. N. 48° 12′, long. W. 122° 49′, 40 fathoms; Station 2866, lat. N. 48° 09′, long. W. 125° 03′, 171 fathoms; Station 3225, lat. N. 54° 48′ 30″, long. W. 165° 49′, 85 fathoms.

The bathymetric distribution of this species is phenomenal, being from shallow water to 1,375 fathoms.

S. tricuspidata, like all other wide ranging species, varies greatly, especially in the size of the hydrothecæ. Clarke found specimens in the material collected by Dr. Dall in Alaska that were very much larger than the typical form. (See Plate XXV, fig. 6.)

S. hesperia Torrey appears to be a synonym for this well-known species. His figures are exactly matched by specimens of *S. tricuspidata* in my possession. The size also agrees, and I am unable to find anything in his description by which I can differentiate his species.

Type.—In Museum of Nat. Hist. Society, Newcastle-upon-Tyne, England.

SERTULARELLA TROPICA Hartlaub.

(Plate XXVI, figs. 3–4.)

Sertularia variabilis Clarke, Bull. Mus. Comp. Zool., XXV, 1894, p. 75.
Sertularella tropica Hartlaub, Revision der Sertularella-Arten, 1900, p. 41.

Trophosome.—Stem sometimes simple, sometimes compound, slightly flexuous, main branches few and irregularly disposed; a pinnate arrangement of the small branches is in some cases well marked. Color, light horn. The hydrothecæ are alternately arranged, usually one to an internode; they are largest near the base, have a tricuspid margin, which is generally thickened and provided with a three-lobed valve; they are strongly divergent and very much exserted. The degree to which they are embedded in the stem varies greatly; in some cases they are scarcely more than attached to the side of the stem, and in others are embedded more than a third of their length.

Gonosome.—The gonangia spring from just below the hydrothecæ, are much elongated, length two and a half to three times their width, the upper portion marked with five or six rings, the opening terminal and tubular, the pedicel extremely short.

Distribution.—*Albatross* Station 3357, lat. N. 6° 35′, long. W. 81° 44′, 782 fathoms; Station 3384, lat. N. 7° 31′ 30″, long. W. 79° 14′, 450 fathoms; Station 3388, lat. N. 7° 06′, long. W. 79° 48′, 1,168 fathoms.

I have not seen this species, and have copied the above description entire from the original by Dr. Clarke. The name given by Dr. Clarke was preoccupied by Bale in 1888[1] and by Clarke himself in 1876[2] and Hartlaub gave the species the name *S. tropica*.

The depth from which this species was dredged is quite exceptional for the genus, and indeed for the family Sertularidæ.

Type.—In Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARELLA CLARKII Mereschkowsky.

(Plate XXVI, fig. 5.)

Sertularella clarkii Mereschkowsky, Ann. and Mag., 5th ser., II, 1878, p. 447.
Sertularella clarkii Hartlaub, Revision der Sertularella-Arten, 1900, p. 25.

"*Trophosome.*—Hydrorhiza forming a compact layer of hydrophytons. Hydrocaulus straight, long, cylindrical, not angularly bent, with regular internodes, destitute of branches to the apex, where the width of the axial tube suddenly diminishes considerably, and it at the same time gives

[1] Proceedings of the Linnæan Society of New South Wales (2), III, p. 764.
[2] Proceedings of the Academy of Natural Sciences of Philadelphia, 1876, p. 1876.

origin to the branches. Branches divided into internodes, rather short, issuing from all sides of the principal stem, one from each of the internodes, ramified in their turn so that each branch internode gives off a secondary branch, which is divided once or twice; and all these secondary branches are turned toward the axis of the colony (inward). Hydrothecæ tubular, a little contracted at the extremity; aperture broad, oval, furnished with two large teeth arranged unsymmetrically; arrangement of the hydrothecæ, although biserial, not in the same plane, having at the first glance the appearance of being uniserial."

Gonosome.—Unknown.

Distribution.—Unalaska (M. Petelin), 1847.

I have not been able to secure a specimen of this species, and have copied the original description entire, as well as the drawing.

Type.—In collection of the Academy of Sciences, St. Petersburg.

SERTULARELLA EPISCOPUS Allman.

(Plate XXVI, fig. 7.)

Sertularia fusiformis Hutton, Trans. New Zealand Inst., V, 1872, p. 257.
Sertularella episcopus Allman, Journ. Linn. Soc. Zool., XII, 1874, p. 263.
Sertularia fusiformis Coughtrey, Trans. New Zealand Inst., VII, 1875, p. 285.
Sertularia longicosta Coughtrey, Ann. and Mag., 4th ser., XVII, 1876, p. 28.
Sertularella episcopus Kirchenpauer, Nordische Gattungen, 1884, p. 51.
Sertularella episcopus Bale, Trans. Royal Soc. Victoria, 1887, p. 103.
Sertularia fusiformis Pfeffer, Die niedere Tierwelt des Ant. Ufergeb., 1893, p. 568.
Sertularella episcopus Farquahr, Trans. New Zealand Inst., XXVIII, 1896, p. 464.
Sertularella episcopus Hartlaub, Revision der Sertularella-Arten, 1900, p. 49.

"*Trophosome.*—Hydrocaulus attaining a height of about an inch, simple, given off at short intervals from a creeping ramified tubular fibre. Hydrothecæ tubiform, springing from the distal end of the supporting internode, to which they are attached by their fundus, free in the remainder of their height, and strongly diverging from the stem; orifice deeply cleft above and below, so as to present a mitre-like form, bordered by a thickened margin, below which, on the side facing the internode, there is a thickened involution of the walls of the hydrotheca.

"*Gonosome.*—Gonangia elongated, ovoid, with one wide and shallow and two narrow and deep longitudinal depressions, which extend from the summit to the base, supported by a short, thickish peduncle springing one from each internode at the side opposite to that which carries the hydrotheca."

Distribution.—New Zealand, Lyall Bay (Hutton); Straits of Magellan (Pfeffer).

I have not seen specimens of this species and have copied the above description from that given by Allman. The form of the gonangia as figured is unique, I believe, among the species of this genus, reminding one of certain ones in the genus *Abietinaria*.

SERTULARELLA MAGNA, new species.

(Plate XXVII, fig. 1.)

Trophosome.—Colony (fragmentary) about 3½ inches high, not fascicled, internodes irregular, long. There is but a single dichotomous branching near the top, the usual axillary hydrotheca being present; but several of the proximal branches are produced into much annulated shoots which resemble the so-called stolons found in various groups of hydroids. Hydrothecæ enormous for this group, being many times as large as those of *S. polyzonias*, alternate, tubular, doubly curved, the distal extremity being turned slightly upward, about the distal two-thirds free; margins several times reduplicated, either smooth or with two or three or sometimes four low inconspicuous teeth. Operculum thick, conspicuous, a simple membrane of a single flap where the margin is even, with two flaps when there are two evident teeth, sometimes apparently with more than two flaps, but they are not well defined, probably because the teeth, when three or four, are very low and inconspicuous.

Gonosome.—Not known.

Distribution.—*Albatross* Station 3480, lat. N. 52° 06′, long. W. 171° 45′, 283 fathoms. Bering Sea.

This species bears some resemblance to *S. gigantea* Mereschkowsky, but the hydrothecæ are quite different in shape. No better example could be found of the futility of basing generic distinction on the number of parts to the operculum. One branch of this species could be placed in three different genera were that criterion to be used.

Type.—In the collection of the U. S. National Museum.

SERTULARELLA FORMOSA Fewkes.

(Plate XXVII, figs. 2–4.)

Sertularella formosa Fewkes, Bull. Mus. Comp. Zool., VIII, No. 7, 1881, p. 130.
Sertularia integritheca Allman, Challenger Report, Hydroida, Pt. 2, 1888, p. 60.
Sertularella formosa Nutting, Bahama Expedition, 1895, p. 88.
Sertularella integritheca Versluys, Hydraires de l'Hirondelle, 1899, p. 37.
Sertularella cylindritheca Hartlaub, Revision der Sertularella-Arten, 1900, p. 77 (part).

Trophosome.—Colony attaining a height of about 6 inches. Stem not fascicled, sinuous, internodes not evident. Branches regularly alternate, there being three hydrothecæ between adjacent branches on the same side, divided into regular internodes each of which bears a hydrotheca. Hydrothecæ entirely exserted, cylindrical, set nearly at right angles with the stem or branch, sides nearly parallel; aperture perfectly round and smooth, except for a submarginal annulation or rim, which is not always present. Operculum apparently wanting. Sometimes, however, it appears in the shape of a thin membrane stretched like a drumhead across the aperture.

Gonosome.—Gonangia oblong-oval, inserted on the bases of the hydrothecæ, with smooth walls and a truncated distal end closed with a four-flapped membranous operculum.

Distribution.—Off Granada, 170 fathoms; off Martinique, 357 fathoms (Fewkes); off Habana, Cuba, abundant, 100 to 200 fathoms (Nutting); Testigos Island, 11 meters (Versluys); *Albatross* Station 2157, lat. N. 23° 10′ 04″, long. W. 82° 21′ 07″, 29 fathoms; Station 2324, lat. N. 23° 10′ 25″, long. W. 82° 20′ 24″, 33 fathoms.

Having secured a portion of Allman's type of *S. integritheca*, and compared it carefully with *S. formosa* Fewkes, I do not hesitate to consider the two species as identical. Hartlaub[1] regards *S. integritheca* and *S. cylindritheca* Allman as identical. Having seen both types, I am unable to agree with him, and the matter is perfectly plain when the types can be consulted.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

SERTULARELLA HARTLAUBI, new species.

(Plate XXVII, fig. 5.)

Trophosome.—Colony (fragmentary) about 2 inches high. Stem straight, dark colored, not fascicled, divided into fairly regular nodes by very faintly marked oblique nodes, each internode bearing a hydrotheca or a hydrotheca and a branch. Branches alternate, given off at right angles to the stem from just below the bases of the hydrothecæ, sharply constricted at their bases. Only the stumps of branches remain in the type specimen, but another specimen from a widely different locality consists apparently of detached branches, which are long and slender with obscure nodes. Hydrothecæ exceedingly shallow, shaped like the base of a low, truncated cone, with its axis forming nearly a right angle with that of the branch; margin perfectly smooth and even; operculum in some cases an adcauline flap, in others apparently an irregularly ruptured membrane stretched straight across the aperture like a drumhead.

Gonosome.—Not known.

Distribution.—*Albatross* Station 2136, lat. N. 17° 43′ 40″, long. W. 75° 38′ 25″, 52 fathoms; Station 2796, lat. S. 8° 5′, long. W. 78° 51′, 33 fathoms.

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[1] Revision der Sertularella-Arten, 1900, p. 77.

This very peculiar species is with doubt referred to the genus *Sertularella*. I take pleasure in naming it in honor of Doctor Hartlaub, who has done more than any other one man to bring order out of chaos in this very perplexing genus.

Type slides.—Cat. No. 19760, U.S.N.M.; Cat. No. 18705, Museum State University of Iowa; also in the collection of the author.

? SERTULARELLA NANA Hartlaub.

(Plate XXVI, fig. 6.)

Sertularella nana Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 361.

Trophosome.—Colony unbranched (fragmentary), about 5 mm. high. Stem not fascicled, slender, divided into irregular internodes by usually distant nodes, proximal hydrothecate nodes smooth, short, not sharply separated from each other; the following internodes longer, bearing as many as four hydrothecæ. Hydrothecæ lying in one plane, alternate, inserted below the internodes, deep, distal portions strongly narrowing and gracefully curved, with convex adcauline side, base somewhat swollen; margin with two teeth, or perfectly smooth, in which case the aperture is beveled so as to be nearly vertical; operculum present.

Gonosome.—Not known.

Distribution.—Found growing on *Lafoëa gracillima* at Bare Island, Puget Sound.

I have not seen this species, and have drawn the above description from that of the original describer. It is almost certain that it is not a *Sertularella*, and would probably go more properly in *Thuiaria*, as used in this work. I do not feel justified in disturbing its position, however, without more evidence.

Type.—In the collection of Professor Schauinsland?

DICTYOCLADIUM Allman.

Trophosome.—Colony flabellate in form. Branches anastomosing and forming a rudely reticulate structure or network. Hydrothecæ on more than two sides of the stem. Aperture without conspicuous teeth. Operculum variable.

Gonosome.—Gonangia borne in the bifurcations of the branches and marked with annular rugosities.

This genus was instituted by Allman to accommodate one of the many new types secured by the *Challenger*.[1] It was also recognized by Marktanner-Turneretscher,[2] although at that time but a single species was known. The one herein described shows more evident relationship to the genus *Sertularella* than did the original type dredged by the *Challenger*, especially in the operculum, which is essentially of the *Sertularella* pattern. Allman makes no mention of this structure, but it is plainly evident in *D. flabellum*, being composed of four distinct flaps, although the teeth are so small as hardly to be evident, being represented merely by four corners to the margin which have the structural effect of low teeth.

DICTYOCLADIUM FLABELLUM, new species.

(Plate XXVIII, figs. 1–3.)

Trophosome.—Colony flabellate in form, attaining a height of about 4 inches and branching in a strictly dichotomous manner; few evident internodes on stem or branches, the only annulations or constrictions ordinarily being those at the origins of branches or branchlets. Branches straight, not flexuose, themselves dichotomously branching in the same plane, the ultimate branches often anastomosing with other branches, forming a rude reticulate pattern.

Hydrothecæ arranged in four longitudinal series on stem and branches, so as to form an ascending spiral, tubular, about the distal one-third free, curved gently outward, margin

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[1] Challenger Reports. The Hydroida Pt. 2, 1888, p 76.

[2] Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 219.

irregular, but usually with a quadrilateral outline, with the corners of the quadrilateral very slightly, if at all produced into four very low obscure teeth; operculum with four flaps.

Gonosome.—Gonangia borne in bifurcations of the branches, very large, ovate, body with shallow broad obscure annulations; neck in the form of a long truncated cone with a round terminal aperture.

Distribution.—*Albatross* Station 2842, lat. N. 54° 15′, long. W. 166° 3′, 72 fathoms; Station 2874, lat. N. 48° 30′, long. W. 124° 57′, 27 fathoms.

Type slides.—Cat. No. 19789, U.S.N.M.; Cat. No. 18721, Museum of State University of Iowa; also in the collection of the author.

DIPHASIA Agassiz (modified).

Trophosome.—Hydrothecæ biserial, opposite or alternate, aperture broad, operculum evident, of a single adcauline flap.

Gonosome.—Gonangia usually differing in the sexes, and marked with spines or lobes; an internal marsupium usually present in the female.

This genus as proposed originally by Louis Agassiz[1] was very inadequately characterized, the only definition being in a footnote, as follows: "In the genus *Diphasia* the fertile hydræ are deeply dentated." Hincks, in his British Hydroid Zoophytes, 1868, insists that the main feature is the marsupial chamber of the female gonangium, in which he is followed by Bale.[2] Four years later Allman[3] called attention to the important character of the lid-like operculum which is more conspicuous and constant in this than in any other genus of the family. Kirchenpauer practically adopted Allman's definition.[4] All of these writers considered the marsupial chamber in the female gonangium as a necessary character of the genus. Levinsen[5] claims that this character is not constant, and occurs also in other genera, and bases his diagnosis of the genus on the characters of the margin and operculum alone, thus including all of the species of *Abietinaria* as used in this work. My own opinion is that *Abietinaria* is a good genus, based on the shape of the hydrothecæ, and can very well be differentiated from *Diphasia* on that character, there being but one form, at least among American species, that cannot readily be relegated to one or the other of these genera, and that is *D. pulchra* Nutting, which in general texture is more closely allied to *Diphasia*, which usually lacks the rigid clear-cut sturdy hydrothecal outline that appears to be characteristic of *Abietinaria*.

KEY TO AMERICAN SPECIES OF DIPHASIA.

Hydrothecæ in strictly opposite pairs borne on sides of hydrocaulus.
    Margin sinuous, but not toothed, hydrothecæ not regularly annulated.
        About one-third of hydrotheca free .... *rosacea.*
        Less than one-third of hydrothecæ free, aperture very wide .... *fallax.*
    Margin with three teeth, hydrothecæ slender, tubular .... *tamarisca.*
    Margin not toothed, hydrothecal walls regularly annulated .... *tropica.*
Hydrothecæ in opposite pairs, borne on front of hydrocaulus .... *digitalis.*
Hydrothecæ not strictly opposite, at least on branches.
    Branches arising from all sides of stem, forming a spiral .... *pulchra.*
    Branching pinnate.
        Each internode of stem bearing a pair of opposite hydrothecæ .... *paarmanni.*
        More than two hydrothecæ to each internode.
            Gonangia with two or more lateral spines .... *corniculata.*
            Gonangia without spines .... *kincaidi.*

[1] Contributions to the Natural History of the United States, IV, 1862, p. 355.
[2] Australian Hydroid Zoophytes, Sydney, 1884, p. 98.
[3] Challenger Report, Hydroida, Pt. 2, London, 1888, p. 63.
[4] Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 237.
[5] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, Copenhagen, 1893, p. 196.

POINTS OF INTERGRADATION BETWEEN DIPHASIA AND OTHER GENERA.

With *Sertularia*, in the general form of the hydrothecæ, as in *D. tropica*, and in the general shape and appearance of the gonangia, as in *D. kincaidi*.

With *Thuiaria*, in the absence of regular internodes, as in *D. kincaidi*, and in the narrow distal end of the hydrothecæ, as in *D. pulchra*.

With *Abietinaria*, in the adcauline operculum, and in the narrowed distal extremity of the hydrothecæ, as in *D. pulchra*.

DIPHASIA ROSACEA (Linnæus).

(Plate XXVIII, figs. 4–5.)

Lily or Pomegranate flowering Coralline Ellis, Essay, 1755, p. 8.
Sertularia rosacea Linnæus, Systema Naturæ, 1758, p. 807.
Sertularia rosacea Houttuyn, Natuurlyke Historie, XVII, 1761, p. 525.
Sertularia nigellastrum Pallas, Elenchus Zoophytorum, 1766, p. 129.
Sertularia rosacea Linnæus, Systema Naturæ, 12th ed., 1767, p. 1306.
Sertularia nigellastrum Boddaert, Lyst der Plant-Dieren, 1768, p. 161.
Sertularia rosa Maratti, De Plantis Zoophytis, 1776, p. 25.
Sertularia rosacea Ellis and Solander, Nat. Hist. Zooph., 1786, p. 39.
Sertularia nigellastrum Wilkins and Herbst, Charakteristik der Thierpflanzen, 1787, p. 168.
Dynamena rosacea Esper, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 194.
Sertularia rosacea Berkenhout, Synops. Nat. Hist. Great Britain, I, 1789, p. 215.
Sertularia rosacea Poiret, Voyage en Barbarie, II, 1789, p. 69.
Sertularia rosacea Esper, Fortsetzungen der Pflanzenthiere, II, 1794–1806, pl. xx.
Sertularia rosacea Bosc, Hist. Nat. Des Vers, III, 1802, p. 91.
Sertularia rosacea Turton, British Fauna, 1807, p. 212.
Sertularia rosacea Jameson, Catalogue Animals Class Vermes, 1811, p. 564.
Dynamena (*Sertularia*) *rosacea* Lamouroux, Bullet. philomatique, 1812, p. 184.
Nigellastrum (*Sertularia*) *nigellastrum* Oken, Lehrbuch der Naturgeschichte, 1815, p. 93.
Nigellastrum (*Sertularia*) *rosacea* Oken, Lehrbuch der Naturgeschichte, 1815, p. 93.
Sertularia rosacea Lamarck, Hist. nat. anim. sans Vert., II, 1816, p. 119.
Dynamena rosacea Lamouroux, Hist. des Polypiers, 1816, p. 178.
Sertularia rosacea Stewart, Elements nat. hist. animal Kingdom, II, 1817, p. 440.
Dinamena rosacea Fleming, British Animals, 1828, p. 544.
Sertularia rosacea Bosc, Hist. nat. des Vers, III, 1830, p. 105.
Sertularia rosacea Johnston, Trans. Nat. Hist. Soc. Northumb, 1832, p. 255.
Dynamena rosacea de Blainville, Manuel d'Actinologie, 1834, p. 484.
Sertularia rosacea Lamarck, Hist. nat. anim. sans vert., 2d ed., 1836, p. 145.
Sertularia rosacea Hassall, Ann. and Mag., VI, 1841, p. 167.
Sertularia rosacea Macgillivray, Ann. and Mag., IX, 1842, p. 463.
Sertularia rosacea Gray, List. British Animals, 1847, p. 69.
Sertularia rosacea Johnston, Hist. Brit. Zooph., 1847, p. 64.
Sertularia rosacea Dalyell, Rare and Remark. Animals of Scotland, I, 1847, p. 159.
Sertularia rosacea Goss, Devonshire Coast, 1857, p. 434.
Sertularia rosacea Alder, Cat. Zooph. Northumb., 1857, p. 24.
Diphasia rosacea L. Agassiz, Cont. Nat. Hist. U. S., IV, 1862, p. 355.
Sertularia rosacea Packard, Canadian Naturalist, Dec. 1863, p. 4.
Dynamena rosacea Kirchenpauer, Neue Sertulariden, 1864, p. 7.
Diphasia rosacea Agassiz, North American Acalephæ, 1865, p. 142.
Diphasia rosacea Hincks[1], British Hydroid Zoophytes, 1868, p. 245.
Diphasia rosacea Verrill, Proc. Am. Assn. Adv. Sci., 1873, p. 364.
Diphasia rosacea McIntosh, Ann. and Mag., 4th ser., XIII, 1874, p. 212.
Diphasia rosacea Schulze, Nordsee Exped., 1874, p. 132.
Diphasia rosacea Verrill, Amer. Journ. Sci., X, 1875, p. 43.
Diphasia rosacea Winther, Naturhist. Tidsskrift, 1880, p. 265.
Diphasia rosacea Driesch, Tektonische Studien, 1890, p. 213.
Diphasia rosacea Marktanner-Turneretscher, Hydroiden des k. k. naturh. Hofmuseums, 1890, p. 238.
Diphasia rosacea Levinsen, Vid. Udb. "Hauchs" Togter, 1893, p. 371.

[1] Authors before Hincks (1868) did not distinguish *D. rosacea* from *D. alternata*, and hence we can only assume that they refer to the originally described form.

Diphrasia rosacea CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Dynamena rosacea BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 79.
Diphasia rosacea NUTTING, Hydroids of the Woods Hole Region, 1901, p. 361.
Diphasia rosacea HARGITT, Amer. Naturalist, 1901, p. 392.
Diphasia rosacea WHITEAVES, Marine Invert. Eastern Canada, 1901, p. 26.
Diphasia rosacea SÆMUNDSSON, Islandske Hydroider, 1902, p. 66.

Trophosome.—Colony attaining a height of 3 or 4 inches, of very delicate texture, translucent. Stem not fascicled, its proximal portion smooth and without hydrothecæ, no regular internodes; remainder divided into regular short internodes, each bearing a pair of opposite hydrothecæ and sometimes a branch. Branches alternate, distant, often irregularly spaced, proximal internode without hydrothecæ, others bearing a pair of opposite hydrothecæ; branches themselves often divided into branchlets. Hydrothecæ strictly opposite, long, tubular, the two of a pair not contingent in front but with their proximal adcauline sides parallel. upper one-third to one-half free and bending abruptly outward and forward and ending in an oblique margin, which is sinuous but not toothed. Operculum of a single adcauline flap, usually situated just at the margin, but when closed sinking considerably below the margin, especially on the adcauline side. Nodes of the branches just between the distal divaricated portions of the hydrothecæ.

Gonosome.—Gonangia borne in rows on the upper sides of branches, male gonangia long, slender, narrowing very gradually proximally to a short curved pedicel and very abruptly distally to a small tubular neck and minute round aperture; sides ornamented with eight compressed longitudinal ridges ending in points on distal end of gonangia. Four to eight spermaries are seen in a row through the transparent gonangial walls. Female gonangia larger, more robust, pyriform, with eight conspicuous longitudinal ridges ending in lamellate processes which curve inward toward a common center, and two of which, on opposite sides, are much larger than the other six; apparently an internal marsupial chamber of globular form can be seen in mature gonangia.[1] When immature the gonangia are obconical in form, with eight regularly spaced projections around the top.

Distribution.—New England coast, common (Verrill); Labrador (Packard); Gulf of St. Lawrence (Whiteaves); British coasts (Hincks); Denmark (Winther); Norway (Levinsen); Iceland (Sæmundsson); North Sea (Schulze).

Albatross Station 2250, lat. N. 40° 17′ 15″, long. W. 69° 51′ 45″, 47 fathoms.

This is a well-known shallow water species, occurring from tide level to about 50 fathoms.

DIPHASIA TAMARISCA (Linnæus).

(Plate XXVIII, figs. 6–7.)

Sea tamarisk ELLIS, Nat. Hist. Corallines, 1755, p. 4.
Sertularia tamarisca LINNÆUS, Systema Naturæ, 1758, p. 808.
Sertularia tamarisca HOUTTUYN, Natuurlyke Historie, XVII, 1761–1773, p. 533.
Sertularia tamarisca PALLAS, Elenchus Zoophytorum, 1766, p. 129.
Sertularia tamarisca LINNÆUS, Systema Naturæ, 1767, p. 1307.
Sertularia tamarisca BODDAERT, Lyst der Plant-Dieren, 1768, p. 160.
Sertularia tamariscus MARATTI, De Plantis Zoophytis, 1776, p. 26.
Sertularia Tamarisca GRONOVIUS, Zoophylacium gronovianum, 1781, p. 357.
Sertularia tamarisca ELLIS and SOLANDER, Nat. Hist. Zooph., 1786, p. 36.
Sertularia tamarisca WILKINS and HERBST, Charakteristik der Thierpflanzen, 1787, p. 167.
Sertularia tamarisca GMELIN, Systema Naturæ, Linnæus, I, 1788–1793, p. 3845.
Sertularia tamarisca BERKENHOUT, Synops. Nat. Hist. Great Britain, I, 1789, p. 216.
Sertularia tamarisca OLIVI, Zoologia Adriatica, 1792, p. 288.
Sertularia tamarisca LAMARCK, Systême des anim. sans Vert., 1801, p. 382.
Sertularia tamarisca BOSC, Hist. nat. des Vers, III, 1802, p. 92.
Sertularia tamarisca TURTON, British Fauna, 1807, p. 212.
Sertularia tamarisca LAMOUROUX, Bullet. Philomatique, 1812, p. 184.
Nigellastrum (*Sertularia*) *tamarisca* OKEN, Lehrbuch der Naturgeschichte, 1815. p. 93.
Sertularia tamarisca LAMOUROUX, Hist. nat. des Polypiers, 1816, p. 188.

[1] See explanation of this appearance on pp. 30–32.

Sertularia tamarisca STEWART, Elements Nat. Hist. Animal Kingdom, II, 1817, p. 441.
Dinamena tamarisca DE BLAINVILLE, Manuel d'Actinologie, 1834, p. 483.
Sertularia tamarisca LAMARCK, Hist. nat. anim. sans Vert., 1836, p. 153.
Sertularia tamarisca HASSALL, Ann. and Mag., VI, 1841, p. 168.
Dinamena tamarisca FLEMING, British Animals, 1842, p. 543.
Sertularia tamarisca MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 164.
Sertularta tamarisca GRAY, British Animals, 1843, p. 72.
Sertularia tamarisca JOHNSTON, Hist. Brit. Zooph., 1847, p. 74.
?*Sertularia producta* STIMPSON, Marine Invert. Grand Manan, 1854, p. 8.
Sertularia tamarisca ALDER, Cat. Zooph. Northumb., 1857, p. 25.
Sertularia tamarisca ALLMAN, Ann. and Mag., 3d ser., III, 1859, p. 238.
Diphasia tamarisca AGASSIZ, Cont. Nat. Hist. U. S., IV, 1862, p. 355.
?*Sertularia producta* A. AGASSIZ, North American Acalephæ, 1865, p. 145.
Diphasia tamarisca HINCKS, British Hydroid Zoophytes, 1868, p. 254.
Diphasia tamariska SARS, Bidrag til Kundskaben, 1873, p. 19.
Diphasia tamarisca SCHULZE, Nordsee Exped., 1874, p. 132.
Diphasia tamarisca CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Dynamena tamarisca BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 81.

"Shoots stout and erect, irregularly branched, the branches commonly alternate, sometimes opposite, long, simple or variously branched. Hydrothecæ very large, cylindrical, the upper half free and divergent, with a wide tridentate aperture; gonothecæ (male) compressed, obcordate, attenuated below, broad and truncated above, with a small spine at each side, and a central tubular aperture; (female) elongate, oval below, above three-sided with a pyramidal summit, the edges of the pyramid serrated and its basal angles produced into spines."

Distribution.—? Grand Manan (Stimpson); Great Britain (Hincks); Adriatic (Olivi); North Sea (Schulze); Norway (Sars); Bay of Biscay (Beltremieux, *teste* Hincks).

I have not seen this species, and the above description is taken entire from that of Hincks, which seems to be the best one available. The species may not be American, and is introduced here because it seems that the *Sertularia producta* of Stimpson is this form, a view entirely consistent with his description, which is as follows: "Cells opposite, elongated, curving outward, with ovate apertures. Vescicles slender, elongated, subtruncate and covered with spines at their extremities. It differs from *S. margareta* Hassall, in having more numerous spines at the top of the vescicle and none on its sides." It seems evident that Hincks regarded *S. producta* as a synonym of *D. tamarisca*, although he does not say so directly. He does, however, assign it to Grand Manan on authority of Stimpson, in his account of the distribution of the species, and as Stimpson does not mention *D. tamarisca*, but does describe the species *S. producta*, which answers to the description of *D. tamarisca*, it seems certain that Hincks regarded the two as identical species.

DIPHASIA FALLAX (Johnston).

(Plate XXIX, figs. 2–6.)

Dynamena pinnata FLEMING, Hist. Brit. Animals, 1828, p. 545.
Sertularia pinnata JOHNSTON, British Zoophytes, 1838, p. 127.
Sertularia pinnata MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 463.
Sertularia fallax JOHNSTON, British Zoophytes, 1847, p. 73.
Sertularia fallax STIMPSON, Marine Invert. Grand Manan, 1854, p. 9.
Sertularia fallax ALDER, Cat. Zooph. Northumb., 1857, p. 24.
Diphasia fallax A. AGASSIZ, North American Acalephæ, 1865, p. 142.
Diphasia fallax HINCKS, British Hydroid Zoophytes, 1868, p. 249.
Diphasia fallax VERRILL, Proc. Am. Assn. Adv. Sci., 1873, p. 364.
Diphasia fallax VERRILL, Amer. Journ. Sci. and Arts, VII, 1874, p. 44.
Diphasia fallax VERRILL, Amer. Journ. Sci. and Arts, VII, 1874, p. 504.
Diphasia fallax FEWKES, Bullet. Essex Inst., XXIII, 1891, p. 38.
Diphasia fallax LEVINSEN, Vid. Meddel. naturh. Foren., 1892, p. 55.
Dynamena fallax BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 78.
Diphasia fallax NUTTING, Hydroids of the Woods Hole Region, 1901, p. 361.
Diphasia fallax HARGITT, American Naturalist, 1901, p. 391.
Diphasia fallax WHITEAVES, Marine Invert. Eastern Canada, 1901, p. 26.
Diphasia fallax SÆMUNDSSON, Islandske Hydroider, 1902, p. 66.

Trophosome.—Colony attaining a height of 3 or 4 inches. Stem not fascicled, proximal part smooth and without regular nodes, remainder divided into regular internodes each of which bears a pair of hydrothecæ and sometimes a branch. Branches irregularly alternate, the proximal internode bearing a pair of hydrothecæ as do all the others; branches often terminating in a long hooked, tendril-like process and often dividing into branchlets. Hydrothecæ opposite, tubular, rather short and stout, those of a pair rather widely separated, adnate to branch for about three-fourths their height, the distal one-fourth being abruptly divergent and ending in a large broadly sinuous margin, the aperture reaching nearly or quite to the branch. Operculum a single large adcauline flap.

Gonosome.—Gonangia borne in rows on front of branches. Female gonangia oblong-ovate in general outline, the summit crowned by four long pointed lobes or flaps of equal size, converging above. The appearance of an internal marsupial chamber is present in mature specimens. Male gonangia much smaller, summit quadrangular, with each angle produced into a tubular process and the center occupied by a small tubular neck terminating in a minute aperture.

Distribution.—New England coast (Verrill); Grand Manan (Stimpson); mouth of St. Lawrence (Whiteaves); British coasts (Johnston); west coast of Greenland (Levinsen); Tromsoe, Norway (Sars); Iceland (Sæmundsson); U. S. Fish Commission Station 770, Narragansett Bay, 8¼ fathoms.

This species seems to be confined to shallow water.

DIPHASIA TROPICA, new species.

(Plate XXX, fig. 1.)

Trophosome.—Colony unbranched, arising from a creeping root-stalk and attaining a height of one-fourth inch. Stem slender, not fascicled, divided into regular internodes, each of which bears a pair of strictly opposite hydrothecæ. Hydrothecæ tubular, five-sided, contingent in front for nearly half their length, scarcely touching each other on the posterior side of stem. Three of the sides of each hydrotheca are seen from the front and two from behind. Distal half free and curving regularly outward and a little upward. Margin circular, aperture closed by an operculum which is adcauline in position. The hydrothecæ are ornamented throughout by pronounced compressed external ridges running entirely around the walls, closely set and parallel to each other, forming a conspicuous and unique ornamentation. Pairs of hydrothecæ are separated by about their own height.

Gonosome.—Not known.

Distribution.—Shallow water between Eleuthera and Little Cat Island. Collected by the Bahama expedition from the State University of Iowa.

The beautiful and regular annulation and the five sides to the hydrothecæ are features that render this species peculiarly striking and distinct.

Type slides.—Cat. No. 19804, U.S.N.M.; Cat. No. 18729, Museum State University of Iowa; also in collection of the author.

DIPHASIA DIGITALIS (Busk).

(Plate XXX, figs. 2–7.)

Sertularia digitalis Busk, Voyage of *Rattlesnake*, I, 1852, pp. 387, 393.
Desmoscyphus longitheca Allman, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 26.
Diphasia digitalis Bale, Australian Hydroid Zoophytes, 1884, p. 101.
Desmoscyphus acanthocarpus Allman, Challenger Report, Hydroida, Pt. 2, 1888, p. 73.

Trophosome.—Stem not fascicled, attaining a height of about 4 inches, divided into regular but obscure internodes, each of which bears a pair of opposite hydrothecæ and occasionally a branch. Branches irregularly alternate, arising from short processes which spring from the postero-lateral surface of the stem, rigid, divided into regular internodes, each of which bears a pair of hydrothecæ on its anterior face. Hydrothecæ borne on front of the stem in pairs the individuals of which are contingent on their adcauline sides for almost their entire length, long,

tubular, squarish in cross section, closely approximated, parallel to each other and to the branch for nearly their entire length, their short free distal ends bending outward and forward; margin sinuous, but not toothed; aperture large, directed more nearly upward than is usual in this genus; operculum very conspicuous, forming an arched cap over the aperture.

Gonosome.—Gonangia attached to the back of stem, small, pellucid, oblong-oval, with a short, tubular neck and with the walls beset throughout with small, sharp, thorn-like spines.

Distribution.—West Indian region and Florida keys, Bahama expedition from the State University of Iowa; off Bahia, Brazil, *Challenger;* Key West (Allman); Prince of Wales Channel, Torres Strait (Busk); *Albatross* Station 2323, lat. N. 23° 10′ 51″, long. W. 82° 19′ 03″, 163 fathoms; Station 2333, lat. N. 23° 10′ 36″, long. W. 82° 19′ 12″, 169 fathoms; Station 2350, lat. N. 23° 10′ 39″, long. W. 82° 20′ 21″, 213 fathoms.

Having examined Allman's type of *Desmoscyphus acanthocarpus* and compared it with his *Desmoscyphus longitheca*, I have no hesitation in declaring them identical. Bale[1] calls attention to the close resemblance between *D. longitheca* Allman and *S. digitalis* Busk. The drawings and descriptions of this latter species given by Bale agree exactly with the type of *D. acanthocarpus* Allman. Busk's description has the priority, and the other two must be regarded as synonyms.

Type.—In South Kensington Museum, London. Fragment in possession of the author.

? DIPHASIA PULCHRA, new species.

(Plate XXXI, figs. 1–3.)

Trophosome.—Colony attaining a height of about 5 inches. Stem strongly geniculate, divided into fairly regular internodes, at least in distal part, each internode giving forth a branch, the nodes being just under the processes which support the branches. Branches arranged in a spiral, rising gracefully from the main stem, forming a dense, symmetrical, bushy tuft, giving a very elegant appearance to the colony; branches divided into long internodes, each of which bears several hydrothecæ. Hydrothecæ rather distant, subalternate, long, pitcher-shaped, the distal end narrowed and terminating in a mouth like that of a pitcher; margin with two broad opposite teeth, and a sinuation or excavation on the adcauline side, where the one-flapped operculum is attached.

Gonosome.—Not known.

Distribution.—*Albatross* Station 2863, lat. N. 48° 58′, long. W. 123° 10′, 67 fathoms.

This graceful species bears considerable resemblance to certain forms of *Thuiaria*, but seems to have more affinities for *Diphasia*, where it is provisionally placed. When the gonosome is discovered it may be necessary to place it in another genus.

Type slides.—Cat. No. 19799, 19800, U.S.N.M.; Cat. No. 18724, Museum of State University of Iowa; also in the collection of the author.

DIPHASIA PAARMANNI, new species.

(Plate XXXI, figs. 4–6.)

Trophosome.—Colony erect, rigid, plumiform, attaining a height of about 3 inches. Stem stiff, straight, the proximal unbranched part smooth and without nodes, the remainder divided into obscure but regular internodes, each of which bears a pair of opposite hydrothecæ and a branch. Branches strictly alternate, stiff, divided from the stem by a sharp basal constriction; internodes regular, each bearing two alternate hydrothecæ and divided by oblique nodes. Hydrothecæ alternate on branches, opposite on main stem, rather distant, about the distal one-third free, tubular, curving gently outward, ending in a sinuous margin shaped like the mouth of a pitcher. Operculum adcauline, consisting of a single flap.

Gonosome.—Gonangia borne in rows along the front of branches. Female gonangia large, oblong-ovate, proximal end narrowing to a short slender pedicel, distal end dome-shaped and consisting of four large lobes with contiguous or coalesced edges arching over to form the dome;

[1]Australian Hydroid-Zoophytes, 1884, p. 101.

an internal marsupium is present in mature specimens. Male gonangia rather slender for this genus, oblong conoid, with six to eight longitudinal ridges becoming more prominent distally and ending in a circle of six to eight elevated points, which surround the slender tubular neck which occupies the center of the distal end of the gonangium.

Distribution.—*Albatross* Station 2415, lat. N. 30° 44′, long. W. 79° 26′, 440 fathoms; Station 2663, lat. N. 29° 39′, long. W. 79° 49′, 421 fathoms; Station 2666, lat. N. 30° 47′ 30″, long. W. 79° 49′, 270 fathoms; Station 2668, lat. N. 30° 58′ 30″, long. W. 79° 38′ 30″, 294 fathoms.

This species seems to be the most southerly in its distribution of all of the typical *Diphasia* species, and is also found in deeper water than is usual in this group. It is probably nearest *D. pinnata*, from which it differs in having a sharp constriction at the base of each branch, alternate and more distant hydrothecæ, and in the character of the male gonangium. I take pleasure in naming this very beautiful form in honor of Mr. J. H. Paarmann, who has done much to elucidate the structure of the operculum in this family of hydroids.

Type slides.—Cat. No. 19797, U.S.N.M. Cat. No. 18726, Museum of State University of Iowa; also in collection of the author.

DIPHASIA CORNICULATA (Murray).

(Plate XXIX, fig. 1.)

Sertularia corniculata Murray, Ann. and Mag., 3d ser., V, 1860, p. 251.
Diphasia corniculata A. Agassiz, North American Acalephæ, 1865, p. 143.
Sertularia corniculata Clark, Hydroids of the Pacific Coast, 1876, p. 251.

"Cells not quite opposite, sometimes nearly alternate, forming an open cup resting on the stem; lip not distinct; exterior margin somewhat projecting at tip; a single one in the axilla of each pinna. Vescicles pear-shaped, with two long points projecting like horns at the thick end; aperture between them."

Distribution.—Bay of San Francisco (Murray).

I have not seen this species, and copy the above description, which is entirely inadequate, from the original by Murray. His figure, which I also copy, shows that the gonangia, or at least one of them, resemble that of *D. tamarisca*, but the hydrothecæ seem much stouter and more nearly opposite.

DIPHASIA KINCAIDI (Nutting).

(Plate XXXI, figs. 7–9.)

Thuiaria elegans Nutting, Hydroids of the Harriman Expedition, 1901, p. 187.
Thuiaria kincaidi Nutting, American Naturalist, Sept., 1901, p. 789.
Thuiaria elegans Torrey, Hydroida of the Pacific Coast, 1902, p. 14.

Trophosome.—Colony plumose, attaining a height of about 6 inches. Stem not fascicled, with a row of hydrothecæ on each side, divided by oblique nodes into long and irregular internodes; in distal part each internode bears from two to four branches. Branches irregularly alternate, unbranched for about their proximal half, the distal portion dividing into a number of branchlets, the whole giving a very elegant plumose appearance to the colony. Branches divided into irregular internodes by oblique nodes, each internode ordinarily bearing more than two hydrothecæ. Hydrothecæ subalternate, short, stout, pitcher-shaped, the abcauline outline being a double curve and the adcauline a single curve; margin sinuous, like the mouth of a pitcher. Operculum consisting of a large, slightly vaulted adcauline flap. The top of one hydrotheca is separated by a considerable space from the bottom of the one immediately above it.

Gonosome.—Gonangia arranged in crowded double rows along the distal parts of the stem and branches, small for this genus, rather slender, oblong-oval, the distal end truncated and entirely occupied by the large round aperture. There is an internal distal plug which appears as a dark collar in fresh specimens. The gonangia have no spines or external projections of any sort.

Distribution.—Berg Inlet and Dutch Harbor, Alaska (Nutting). Collected by the Harriman Alaska Expedition.

Type slides.—Cat. Nos. 19795, 19796, U.S.N.M. Cat. No. 18725, Museum of State University of Iowa; also in the collection of the author.

ABIETINARIA Kirchenpauer (modified).

Trophosome.—Hydrothecæ not strictly opposite, more or less bottle-shaped (the proximal portion turgid, distal portion narrowed), operculum of a single adcauline flap, margin usually without teeth.

Gonosome.—Gonangia plain, corrugated or ribbed, without lateral spines and without an internal marsupium.

This genus was proposed by Kirchenpauer[1] to include a few species allied to *Sertularia abietina* of authors, his formal characterization being as follows, freely translated:

Sertularians with branched stem. Stem or branch bearing pinnate branches. Hydrothecæ flask-shaped, decidedly bulging (ventricose), with a tubular neck, and aperture directed laterally.

Neither Kirchenpauer nor Marktanner-Turneretscher,[2] who adopted this genus, recognized the important character of an adcauline operculum, the latter writer expressly stating that *Abietinaria* is composed of nonoperculate forms. Levinsen, on the other hand, placed great stress on the operculum, as we have seen, and included all species with a single-flapped adcauline operculum in the genus *Diphasia*.[3] Here, again, it seems to me, that reliance on a single character has been misleading and has resulted in an unnatural association of species.

The genus as above defined appears to be a fairly natural group, and one easily identified in nearly all cases. Of course the operculum is sometimes difficult to make out by the novice, but any good observer should be able to detect it and to decide whether it is adcauline or abcauline, thus differentiating between *Abietinaria* and *Thuiaria* in cases where other characters fail. In most cases the general shape of the hydrothecæ will at once determine the matter.

POINTS OF INTERGRADATION BETWEEN ABIETINARIA AND OTHER GENERA.

With *Thuiaria*, in general shape of hydrotheca, extent of immersion of hydrothecæ, and character of margin and aperture, as in *A. annulata*, Kirchenpauer, *A. turgida* Clark, and *A. gigantea* Clark. In all of these cases the operculum is evidently of a single adcauline flap.

With *Diphasia*, in the character of the margin and operculum. This prevails throughout the genus, and makes it necessary to consider other characters that are given in the definition of the genus *Abietinaria*, particularly the shape of the hydrothecæ. In those cases where the hydrothecæ are not typically bottle-shaped, as in *A. turgida* and *A. gigantea*, the orifice is still much more constricted than the body of the hydrothecæ, and in none of these cases does the gonosome resemble that which is characteristic of *Diphasia*.

This genus is essentially arctic and north temperate in distribution, a great majority of species occurring in particularly luxuriant colonies in the cold waters of Alaska. Not a single American species is found in tropical seas, and none extends south of California, on the Pacific coast, or south of New England, on our North Atlantic coast. One species, *A. abietina*, extends to the Mediterranean, on the east shores of the Atlantic.

KEY TO THE AMERICAN SPECIES OF THE GENUS ABIETINARIA.

- More than one-fourth of adcauline wall free.
  - Hydrothecæ not leaning forward in noticeable degree.
    - Internodes of stem fairly regular, each bearing a branch.
      - Hydrothecæ large and fairly robust.
        - Gonangia not top-shaped nor annulated.
          - Not more than one-third of hydrothecal wall adnate .... *abietina*.
          - At least half of adcauline wall adnate.
            - Gonangia with broad aperture .... *variabilis*.
            - Gonangia with narrow aperture .... *inconstans*.
        - Gonangia top-shaped, with annular rugosities .... *coei*.
      - Hydrothecæ small and delicate, nearly opposite .... *filicula*.

[1] Nordische Gattungen und Arten, 1884, pp. 29–31.

[2] Die Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, pp. 220, 244.

[3] Videnskabelige Meddelelser fra den naturhistoriske Forening, Kjøbenhavn, 1892, p. 196.

Internodes of stem irregular.
Distal ends of hydrothecæ very greatly narrowed, hydrothecæ very short .... *traski.*
Distal ends of hydrothecæ much compressed .... *amphora.*
Distal ends of hydrothecæ not greatly compressed.
More than one-half of adcauline wall adnate .... *anguina.*
About one-third of adcauline wall adnate .... *gracilis.*
Hydrothecæ leaning forward in noticeable degree.
Ends of hydrothecæ much compressed .... *compressa.*
Ends of hydrothecæ not noticeably compressed.
Hydrothecæ not curved .... *alexanderi.*
Hydrothecæ distinctly curved.
Hydrothecal margin with two adcauline teeth in some cases, and without teeth in others, in the same colony. Gonangia annulated .... *greenei.*
Margin always without teeth, gonangia with longitudinal ribs .... *costata.*
Less than one-fourth of adcauline wall free.
Stem very dark, thick, and woody, not translucent .... *annulata.*
Stem thick, but not woody, horn color, translucent.
Stem with regular internodes, each bearing a pair of hydrothecæ .... *turgida.*
Stem with irregular internodes .... *gigantea.*

ABIETINARIA ABIETINA (Linnæus).

(Plate XXXII, figs. 1-3.)

Sea fir Ellis, Essay Nat. Hist. Cor., 1755, p. 4.
Sertularia abietina Linnæus, Systema Naturæ, 1758, p. 808.
Sertularia abietina Linnæus, Fauna Suecica, 1761, p. 540.
Sertularia abietina Houttuyn, Natuurlyke Historie, XVII, 1761–73, p. 534.
Sertularia abietina Baster, Dissertation de Zoophytis, 1762, p. 113.
Sertularia abietina Pallas, Elenchus Zoophytorum, 1766, p. 133.
Sertularia abietina Linnæus, Systema Naturæ, 1767, p. 1307.
Sertularia abietina Boddaert, Lyst der Plant-Dieren, 1768, p. 166.
Sertularia abietina Olafsen and Povelsen, Rejse igiennem Island. Soröe, 1772, p. 40.
Sertularia abietina Maratti, De Plantis Zoophytis, 1776, p. 27.
Sertularia abietina Müller, Zoologiæ Danicæ, 1776, p. 255.
Sertularia abietina Fabricius, Fauna Grœnlandica, 1780, p. 442.
Sertularia abietina Gronovius, Zoophylacium gronovianum, 1781, p. 357.
Sertularia abietina Ellis and Solander, Nat. Hist. Zooph., 1786, p. 36.
Sertularia abietina Wilkins and Herbst, Charakteristik der Thierpflanzen, 1787, p. 172.
Sertularia abietina Gmelin, Systema Naturæ (Linnæus), 1788–93, p. 3845.
Sertularia abietina Esper, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 171.
Sertularia abietina Berkenhout, Synops. Nat. Hist. Great Britain and Ireland, I, 1789, p. 216.
Sertularia abietina Poiret, Voyage en Barbarie, II, 1789, p. 70.
Sertularia abietina Esper, Fortsetzungen der Pflanzenthiere, II, 1794–1806, pl. i.
Sertularia abietina Bosc, Hist. Nat. des Vers, II, 1802, p. 92.
Sertularia abietina Turton, British Fauna, 1807, p. 212.
Sertularia abietina Jameson, Cat. Animals Class Vermes, 1811, p. 564.
Sertularia abietina Lamouroux, Bull. philomatique, 1812, p. 184.
Nigellastrum abietinum Oken, Lehrbuch der Naturgeschichte, 1815, p. 93.
Sertularia abietina Lamarck, Hist. nat. anim. sans vert., II, 1816, p. 116.
Sertularia abietina Lamouroux, Hist. des Polypiers, 1816, p. 187.
Sertularia abietina Stewart, Elements Nat. Hist. Animal King., II, 1817, p. 441.
Sertularia abietina Schweigger, Handbuch der Naturgeschichte, 1820, p. 427.
Sertularia abietina Lamouroux, Exposition Méthodique, 1821, p. 12.
Sertularia abietina de Blainville, Manuel d'Actinologie, 1834, p. 480.
Sertularia abietina Oken, Allgemeine Naturgeschichte, 1835, p. 80.
Sertularia abietina Lamarck, Hist. nat. anim. sans vert., 1836, p. 141.
Sertularia abietina Gray, British Animals, 1841, p. 72.
Sertularia abietina Hassall, Ann. and Mag., VI, 1841, p. 168.
Dynamena abietina Fleming, British Animals, 1842, p. 543.
Sertularia abietina Macgillivray, Ann. and Mag., IX, 1842, p. 464.
Sertularia abietina Hyndman, Ann. and Mag., X, 1842, p. 20.
Sertularia abietina Dalyell, Rare and Remark. Anim. Scotland, 1847, p. 150.
Sertularia abietina Johnston, Hist. British Zoophytes, 2d ed., 1847, p. 75.
Sertularia abietina Gosse, Devonshire coast, 1853, p. 434.

Sertularia abietina ALDER, Cat. Zooph. Northumb., 1857, p. 25.
Sertularia abietina ALEXANDER AGASSIZ, North American Acalephæ, 1865, p. 143.
Sertularia abietina HELLER, Zooph. and Echinodermen, 1868, p. 34.
Sertularia abietina VAN BENEDEN, Fauna Littorale, 1866, p. 185.
Sertularia abietina HINCKS, British Hydroids, 1867, p. 266.
Sertularia abietina SCHULZE, Nordsee Exped., 1872, p. 132.
Sertularia abietina MCINTOSH, Ann. and Mag., 4th ser., XIII, 1874, p. 213.
Sertularia abietina MERESCHKOWSKY, Ann. and Mag., 5th ser., I, 1878, p. 324.
Sertularia abietina WINTHER, Naturhist. Tidsskrift, 1879–80, p. 250.
Abietinaria abietina KIRCHENPAUER, Nordische Gattungen, 1884, p. 31.
Sertularia abietina BERGH, Goplepolyper fra Kara Havet, 1887, p. 335.
Sertularia abietina ALLMAN, Challenger Report, Hydroida, Pt. 2, 1888, p. 62.
Sertularia abietina DRIESCH, Tektonische Studien, 1890, p. 202.
Abietinaria abietina MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 245.
Sertularia abietina BOURNE, Hydroids of Plymouth, 1890, p. 397.
Diphasia abietina LEVINSEN, Vid. Meddel. naturh. Foren., 1892, p. 56.
Sertularia abietina CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Sertularia abietina HARTLAUB, Hydromedusen Helgolands, 1897, p. 451.
Thuiaria abietina BONNEVIE, Norwegian North Atl. Exped., 1899, p. 10.
Sertularella abietina NUTTING, Hydroids of the Woods Hole Region, 1901, p. 361.
Sertularia abietina WHITEAVES, Cat. Marine Invert. Eastern Canada, 1901, p. 25.
Diphasia abietina SÆMUNDSSON, Bidrag til Kundskaben om islandske Hydroider, 1902, p. 65.

Trophosome.—Colony sometimes attaining a height of 12 to 14 inches. Main stem heavy, flexuose or feebly geniculate, divided into fairly regular internodes by oblique nodes, each internode bearing a branch and two hydrothecæ on one side and one hydrotheca on the other. Branches regularly alternate, pinnate, themselves sometimes branched, divided into internodes of very irregular length, bearing from two to many hydrothecæ. Hydrothecæ very large, subopposite to alternate, flask-shaped or bottle-shaped, gibbous below, narrowing above into a gracefully curved neck ending in a round smooth margin which incloses an aperture directed upward and slightly outward; distal one-third entirely free from the hydrocaulus; operculum (seldom seen in preserved specimens) consisting of a single adcauline flap.

Gonosome.—Gonangia borne on the upper sides of the branches, rather small in comparison to the hydrothecæ, oval, with a very short pedicel, a short collar, wide terminal aperture, and an operculum. Some specimens are more or less annulated.

Distribution.—One of the common species on European and British coasts. Woods Hole Region (Nutting), Newfoundland (Stimpson), Gulf of St. Lawrence (Whiteaves), Labrador (Packard), Mediterranean (Pallas), Adriatic (Heller), Belgium (van Beneden), British coasts (Hincks), North Cape (Sars), North Sea (Schulze), Polar Sea (Bergh), Iceland (Sæmundsson), Greenland (Fabricius), Alaska (Lieut. Geo. M. Stoney, U. S. Navy), Bering Sea (*Albatross* collections), off Washington (*Albatross* collections); *Albatross* Station 2864, lat. N. 48° 22′, long. W. 122° 51′, 48 fathoms; Station 3159, lat. N. 37° 47′ 20″, long. W. 123° 10′, 27 fathoms; Station 3443, lat. N. 48° 13′ 30″, long. W. 123° 11′ 20″, 97 fathoms; Station 3546, lat. N. 54° 12′, long. W. 165° 42′, 36 fathoms; Station 3552, lat. N. 56° 28′, long. W. 169° 28′, 54 fathoms.

This species flourishes best in northern waters, and I have no record of its occurrence south of Massachusetts on our east coast nor south of Washington on the Pacific. The Mediterranean record of Pallas seems somewhat doubtful. It appears to thrive best in depths of 30 to 100 fathoms.

ABIETINARIA VARIABILIS (Clark).

(Plate XXXII, figs. 4–7.)

Sertularia variabilis CLARK, Alaskan Hydroids, 1876, p. 221.
Abietinaria variabilis KIRCHENPAUER, Nordische Gattungen, 1884, p. 35.
Sertularia variabilis NUTTING, Hydroids of Alaska and Puget Sound, 1899, p. 741.
Thuiaria variabilis NUTTING, Hydroids of the Harriman Exped., 1901, p. 185.

Trophosome.—Colony attaining a height of about 5 inches in largest specimens. Stem stout, rigid, flexuose, divided into fairly constant internodes each of which bears two hydrothecæ and a branch on one side and a single hydrotheca on the other in some specimens, while in others the internodes are long and irregular and the branches far apart. Branches alternate typically, but

sometimes very irregularly so, often divided into internodes each of which bears two hydrothecæ, but in other cases with no nodes at all, unless the constriction of the base be regarded as such. Hydrothecæ exceedingly variable, those in typical specimens collected by Dr. Dall are very short and stout, subalternate, swollen below, rapidly constricting throughout their free distal third, and ending in a smooth circular margin and aperture directed upward and outward. There is often a sharp constriction or indentation just below the margin on the adcauline side. The operculum could not be seen in specimens examined, but is doubtless present in fresh specimens and consists of one adcauline flap. All intergradations occur between the hydrotheca above described and one much more slender with distal one-half free and aperture horizontal.

Gonosome.—Gonangia ovate, small, borne on upper sides of branches, with a large distal aperture and a row of chitinous points some distance below the aperture. Another form described by Clark is pyriform instead of ovate.

Distribution.—Abundant on Alaskan coasts, Aleutian Islands, Bering Sea, San Miguel Island, California (Dall); *Albatross* Station 2857, lat. N. 58° 05′, long. W. 150° 46′, 51 fathoms; Station 2864, lat. N. 48° 22′, long. W. 122° 51′, 48 fathoms; Station 2866, lat. N. 48° 09′, long. W. 125° 03′, 171 fathoms; Station 2886, lat. N. 43° 59′, long. W. 124° 56′ 30″, 50 fathoms; Station 3231, lat. N. 58° 35′, long. W. 157° 28′ 50″, 12 fathoms; Station 3465, lat. N. 48° 21′, long. W. 123° 14′, 48 fathoms; Station 3599, lat. N. 52° 05′, long. E. 177° 40′, 55 fathoms; Puget Sound (Nutting).

This is one of the most variable species known, and it is fortunate that Dr. Dall secured a large series showing the intergradations between the extreme forms. The species ranges from shallow water to a depth of 171 fathoms.

Type.—In the collection of the U. S. National Museum.

ABIETINARIA INCONSTANS (Clark).

(Plate XXXIII, figs. 1–2.)

Sertularia inconstans CLARK, Alaskan Hydroids, 1876, p. 222.
Abietinaria inconstans KIRCHENPAUER, Nordische Gattungen, 1884, p. 36.

Trophosome.—Colony attaining a height of about 1 inch in specimens examined. Stem very stiff and coarse, dark colored, divided into numerous sharply separated internodes on proximal unbranched portion; branched portion divided into regular internodes by oblique nodes; internodes each bearing a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches erect, almost parallel with main stem, forming a dense tuft, alternate, basal portion marked by several sharp annulated constrictions, internodes short usually bearing one or two pairs of hydrothecæ. Hydrothecæ very similar to those of *A. filicula*, but much heavier and coarser, although not attaining anything like the size of *A. abietina*, swollen below, the distal third free, narrowing to a circular margin beneath the adcauline side of which is a constriction and thickening of the hydrothecal wall; aperture facing upward. Sometimes there is a chitinous tooth projecting inward from the adcauline margin. Operculum not seen, but doubtless of the regular *Abietinaria* pattern.

Gonosome.—"The gonangia show the greatest amount of variation of any species that I know of; it is impossible to describe their form, for there is not one of them that seems to agree with any other."[1] "Sessile, large, orifice terminal, small, discoidal; outline very irregular, tapering usually at the base; borne in two rows on distal portion of main stem." The present writer has not seen the gonangia.

Distribution.—Unalaska beach (Dall). This species can readily be distinguished from its nearest ally, *A. filicula*, by its thick, dark stems, and very deep annulations and nodes, as well as by the heavier and denser hydrothecæ and ascending branches.

Type.—In the collection of the U. S. National Museum.

[1] Clark, Alaskan Hydroids, 1876, p. 223.

ABIETINARIA COEI (Nutting).

(Plate XXXIII, figs. 3–5.)

Thuiaria coei NUTTING, Hydroids of the Harriman Expedition, 1901, p. 185.

Trophosome.—Colony attaining a height of 3 inches. Stem with several deep annulations near its base, which is constricted; above these annulations the stem is straight, divided into regular short internodes, each bearing a pair of nearly opposite hydrothecæ; above the origin of the first branch the stem becomes geniculate, divided into regular internodes, each of which bears a branch and two hydrothecæ on one side, and a single hydrotheca on the other. Branches alternating, not branching again, rigid, divided into irregular, rather short internodes, each of which usually bears more than one pair of hydrothecæ, although in many terminal branches there is seen the regular sertularian arrangement of an internode to each pair of hydrothecæ. Hydrothecæ of the *filicula* type, subopposite, proximal end swollen, outer edge straight or with a simple curve, distal one-half free and gradually narrowing to the round aperture which opens upward. There is a slight constriction and thickening of the hydrothecal wall on the adcauline side, and a regularly curved chitinous thickening on the inner side of the hydrotheca. Operculum consisting of a single flap attached to the adcauline side of margin.

Gonosome.—Gonangia large, borne on front of main stem and upper sides of branches; top-shaped, with a broad collar and large terminal aperture; proximal portion with broad annular corrugations and narrowing rapidly to a curved short pedicel.

Distribution.—Dutch Harbor, Alaska. Collected by Dr. W. R. Coe of the Harriman Expedition, after whom the species is named; Tledis Village, near Susk, British Columbia, James G. Swan.

Type slides.—Cat. No. 19904, 19906, U.S.N.M. Cat. No. 18749, Museum of State University of Iowa; also in the collection of the author.

ABIETINARIA FILICULA (Ellis and Solander).

(Plate XXXIV, fig. 1.)

Sertularia filicula ELLIS and SOLANDER, Nat. Hist. Zoophytes, 1786, p. 57.
Sertularia filicula GMELIN, Systema Naturae (Linnæus), 1788–93, p. 3853.
Sertularia filicula BOSC, Hist. Nat. des Vers, III, 1802, p. 97.
Sertularia filicula TURTON, British Fauna, 1807, p. 215.
Sertularia filicula JAMESON, Cat. Anim. Class Vermes, 1811, p. 564.
Sertularia filicula LAMARCK, Hist. Nat. Anim. sans Vert., II, 1816, p. 119.
Sertularia filicula LAMOUROUX, Hist. des Polypiers, 1816, p. 188.
Sertularia filicula STEWART, Elements Nat. Hist. Animal Kingdom, II, 1817, p. 445.
Sertularia filicula LAMOUROUX, Exposition Méthodique, 1821, p. 12.
Sertularia filicula BOSC, Hist. Nat. des. Vers, 1830, p. 114.
Sertularia filicula DE BLAINVILLE, Manuel d'Actinologie, 1834, p. 483.
Sertularia filicula LAMARCK, Hist. Nat. Anim. sans Vert., 2d ed., 1836, p. 146.
Sertularia filicula HASSALL, Ann. and Mag., VI, 1841, p. 168
Dinamena filicula FLEMING, British Animals, 1842, p. 544.
Sertularia filicula MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 464.
Sertularia filicula JOHNSTON, Hist. Brit. Zooph., 1847, p. 76.
Sertularia filicula GRAY, List British Animals, 1848, p. 72.
Sertularia filicula STIMPSON, Marine Invert. Grand Manan, 1854, p. 8.
Sertularia filicula ALDER, Cat. Zooph. Northumb., 1857, p. 25.
Sertularia filicula HINCKS, Ann. and Mag., 3d ser., X, 1862, p. 361.
Dynamena filicula KIRCHENPAUER, Neue Sertulariden, 1864, p. 7.
Sertularia filicula A. AGASSIZ, North American Acalephæ, 1865, p. 145.
Sertularia filicula HINCKS, Brit. Hydroid Zoophytes, 1868, p. 264.
Sertularia filicula McINTOSH, Ann. and Mag., 4th ser., XIII, 1874, p. 213.
Sertularia filicula CLARK, Alaskan Hydroids, 1876, p. 219.
Sertularia filicula MERESCHKOWSKY, Ann. and Mag., 5th ser., I, 1878, p. 323.
Sertularia filicula WINTHER, Naturhist. Tidsskrift, 1879–80, p. 277.
Abietinaria filicula KIRCHENPAUER, Nordische Gattungen, 1884, p. 32.
Abietinaria filicula MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturh. Hofmuseums, 1890, p. 245.

Diphasia filicula LEVINSEN, Vid. Meddel. naturh. Foren., 1892, p. 57.
Sertularia filicula CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Thuiaria filicula BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 84.
Thuiaria filicula WHITEAVES, Cat. Marine Invert. Eastern Canada, 1901, p. 25.
?*Sertularia filicula* TORREY, Hydroida of Pacific Coast, 1902, p. 68.

Trophosome.—Almost an epitome of *A. abietina.* Colony attaining a height of about 2 inches. Main stem straight on proximal unbranched portion, geniculate throughout the rest of its extent, divided into fairly regular internodes in the branched portion, each internode bearing a branch and two hydrothecæ on one side and a single hydrotheca on the other. Lower portion with long and irregular internodes. Branches often branching again, divided into irregular internodes which usually bear several hydrothecæ each. Hydrothecæ more nearly opposite than in *A. abietina*, and not so closely approximated, slender, delicate, bottle-shaped, the proximal portion being gibbous, and the distal one-half to one-third narrowing into a slender recurved neck ending in a round aperture which points almost directly upward and is furnished with a one-flapped operculum attached to the adcauline side. Immediately below the attachment of the operculum is a sharp constriction or indentation of the hydrothecal neck.

Gonosome.—Gonangia pyriform, with a short, narrow neck ending in a small, round aperture. They are found both on the stem and branches.

Distribution.—New England coast, Cape Cod to Gulf of St. Lawrence (Verrill); Grand Manan (Stimpson); Labrador (Packard); Alaska (Clark); *Albatross* Station 2865, lat. N. 48° 12′, long. W. 122° 49′, 40 fathoms. Great Britain, north of Scotland to Cornwall (Hincks); White Sea (Mereschkowsky); Christiania (Marktanner-Turneretscher); Greenland (Levinsen); North Atlantic (Bonnevie).

I have not seen this species on our Atlantic coast, although I have examined a great deal of material from that region. If it occurs there it is probably rare. Kirchenpauer[1] considers that the specimens from Alaska described by Clark are a distinct variety from the British form. I can see no material difference between the two. The resemblance between this species and *A. abietina* is so exact in all except size that they would doubtless be regarded as identical, could intergrading specimens be found. Such specimens, however, are not forthcoming, and hence the two species must be held as good.

ABIETINARIA TRASKI (Torrey).

(Plate XXXIII, figs. 6–11.)

Sertularia traski TORREY, Hydroids of Pacific Coast, 1902, p. 69.

Trophosome.—Colony attaining a height of about 6 inches. Stem straight, thick, not fascicled; lower portion without branches or hydrothecæ, smooth, divided into irregular, usually long internodes by deep nodes; upper portion with a double row of hydrothecæ and alternate branches, there being three hydrothecæ between adjacent branches on the same side. Branches much more slender than the stem, alternate, with a deep constriction near the base, nodes entirely absent or distant. Hydrothecæ alternate, rather distant, short and thick, with subtriangular bodies and constricted neck ending in an even margin which is flattened on the adcauline side; aperture directed upward; operculum consisting of a single adcauline flap.

Gonosome.—Gonangia small, ovate, sessile, without ornamentation of any kind; aperture large, round; no collar.

Distribution.—San Pedro, California (Torrey); *Albatross* Station 2861, lat. N. 51° 14′, long. W. 129° 50′, 204 fathoms; Station 2873, lat. N. 48° 30′, long. W. 124° 57′, 40 fathoms; Station 2886, lat. N. 43° 59′, long. W. 124° 56′ 30″, 50 fathoms; Station 3192, lat. N. 35° 33′ 40″, long. W. 121° 15′, 101 fathoms.

This species seems quite distinct, the difference in size between stem and branches and the triangular shape of the hydrothecæ being the main diagnostic features.

Type.—In the collection of the University of California.

[1] Nordische Gattungen und Arten, 1884, p. 32.

ABIETINARIA AMPHORA, new species.

(Plate XXXIV, figs. 2–4.)

Trophosome.—Colony about 4 inches high, consisting of a single straight stem pinnately branched. Stem neither sinuous nor flexuose, proximal unbranched portion deeply but irregularly annulated and without hydrothecæ; distal branched portion with distant and very irregular internodes, and usually with three hydrothecæ between adjacent branches; branches not dividing into branchlets, nodes sometimes entirely absent, usually very distant, there often being but one on a branch, besides the basal constriction. Hydrothecæ subopposite to subalternate, much more closely approximated than in *A. costata* (which has a similar gonosome); basal portion flask-shaped, distal one-half free and curved outward and then upward; margin without teeth, often bearing collapsible tubular membrane; distal end of hydrothecæ dorso-ventrally compressed; aperture oval, directed upward and slightly inward; operculum consisting of a single adcauline flap.

Gonosome.—Gonangia borne on front of stem and sometimes on basal parts of branches, very large, slender, with long neck and round terminal aperture. There are four or five strong longitudinal ridges or crests running from base of neck to near the pedicel.

Distribution.—*Albatross* Station 2841, lat. N. 54° 18′, long. W. 165° 55′, 56 fathoms; Station 2866, lat. N. 48° 09′, long. W. 125° 03′, 171 fathoms; Whidley Island, Puget Sound (specimen from Professor Trevor Kincaid).

This species closely resembles *A. alexanderi*, but its hydrothecæ are not straight, but curved, as is common in the genus. The gonosomes of the two species are entirely different.

Type slides.—Cat. Nos. 19821, 19900, U.S.N.M. Cat. No. 18745, Museum State University of Iowa; also in the collection of the author.

ABIETINARIA ANGUINA (Trask).

(Plate XXXIV, figs. 5–7.)

Sertularia anguina Trask, Proc. Cal. Acad., 1857, p. 112.
Sertularia labrata Murray, Ann. and Mag., 3d ser., V, 1860, p. 250.
Sertularia anguina A. Agassiz, North Amer. Acalephæ, 1865, p. 144.
Sertularia anguina var. *robusta* Clark, Hydroids of Pacific Coast, 1876, p. 255.
Abietinaria labiata Kirchenpauer, Nordische Gattungen, 1884, p. 34.

Trophosome.—Colony attaining a height of about 5 inches. Stem geniculate except on proximal unbranched portion, where it is straight and divided into unequal internodes, distal branched portion divided into unequal internodes, the tendency being to have a branch and two hydrothecæ on one side and a single hydrotheca on the other side of each internode. Branches alternate, divided into unequal internodes, the tendency being to have a pair of hydrothecæ to each internode. As a rule the branches do not subdivide into branchlets. Hydrothecæ large, of the *abietina* type, subopposite to alternate, basal part swollen, distal one-third to one-half narrowing and curving to the round, partially everted margin surrounding the aperture which is usually directed upward; in some cases the margin is distinctly everted all the way around, while in others there is no eversion whatever; operculum adcauline, of a single flap.

Gonosome.—Gonangia small, ovate, with short collar and small aperture, curved slightly in upper part; collar marked with short, spine-like vertical internal projections. Gonangia borne on front of stem and upper side of branches.

Distribution.—San Diego, California (Hemphill); Monterey Bay (Anderson); Vancouver Island (Dawson); San Francisco (Trask); Bering Sea (*Albatross* collections); *Albatross* Station 2842, lat. N. 54° 15′, long. W. 166° 03′, 72 fathoms; Station 3230, lat. N. 58° 31′ 30″, long. W. 157° 13′ 30″, 30 fathoms; Station 3599, lat. N. 52° 05′, long. W. 177° 40′, 55 fathoms.

The specimens that I have seen are from Santa Barbara, California, and Bering Sea, and they all agree well with Doctor Clark's description of *Sertularia anguina* var. *robusta*. The *A. labiata* Murray of Kirchenpauer (incorrectly spelled *labiata* by Kirchenpauer) cannot be identified with certainty by his description, but it may perhaps be identical with *A. coei* Nutting. I am unable to agree with Doctor Torrey in considering this species identical with *A. filicula*.[1]

[1] Hydroida of the Pacific Coast, p. 68. It is possible that the name *anguina* should be retained for the var. *robusta* of Clark, which is apparently distinct.

ABIETINARIA GRACILIS, new species.

(Plate XXXV, figs. 1–2.)

Trophosome.—The largest colony examined was about 3 inches high. Main stem straggling in habit, nearly straight below the lowest branch, the branch-bearing portion being geniculate, divided into irregular internodes, the tendency being to have a branch and two hydrothecæ on one side and one hydrotheca on the other. Branches distant, irregularly alternate, often dividing into branchlets, usually arising from near the base of a hydrotheca, but sometimes springing from the lumen of the hydrotheca as in the specimen figured; divided into irregular internodes, some of which bear but one or two hydrothecæ. Hydrothecæ subopposite to alternate, more distant than in other species of the genus and more slender distally; basal portion flask-shaped, more than the distal half free and gracefully narrowing until near the end, where it expands into an everted rim around the aperture which is abruptly turned upward; operculum consisting of one adcauline flap.

Gonosome.—Gonangia borne on front of main stem, flask-shaped, with short neck and round aperture, ornamented externally with about six conspicuous longitudinal ridges.

Distribution.—*Albatross* Station 2873, lat. N. 48° 30′, long. W. 124° 57′, 40 fathoms; Station 3480, lat. N. 52° 06′, long. W. 171° 45′, 283 fathoms; Station 3599, lat. N. 52° 05′, long. E. 177° 40′, 55 fathoms.

The hydrothecæ of this species are among the most elegantly formed that I have seen among the Sertularidæ. The whole structure of the colony is much less compact than in its allies, bearing more distant branches and hydrothecæ and having a more straggling habit of growth. The hydrothecæ are about the size of *A. filicula*, but their shape is entirely different, as can be seen by comparing the figures.

Type slides.—Cat. Nos. 19914, 19915, U.S.N.M. Cat. No. 18754, Museum of State University of Iowa; also in the collection of the author.

ABIETINARIA COMPRESSA (Mereschkowsky).

(Plate XXXV, figs. 3–4.)

Sertularia compressa Mereschkowsky, Ann. and Mag., 5th ser., II, 1878, p. 446.

"*Trophosome.*—Hydrorhiza in the form of stolons. Hydrocaulus short, erect, not angular, rather rigid, divided into irregular internodes, only giving off very few ramifications. Branches arranged alternately and regularly on two sides of the principal stem, straight, also divided into irregular internodes. Hydrothecæ arranged alternately, subopposite, one to three pairs on each internode, the base inflated and rounded, the upper half strongly compressed in a plane vertical to the plane of ramification of the colony. Aperture oval, compressed, long but narrow, with two angles on the two sides, and two very slightly developed teeth."

Gonosome.—Unknown.

Locality.—Port Ajan (M. Wosnessensky).

I have not seen this species, and have copied the original description entire. I am unable to find any mention of Port Ajan in the atlas at my disposal, and the species may not be American, although all specimens described by Mereschkowsky in the article referred to are from the North Pacific.

Type.—In the collection of the Academy of Sciences, St. Petersburg.

ABIETINARIA ALEXANDERI, new species.

(Plate XXXV, figs. 5–8.)

Trophosome.—Colony attaining a height of about 6 inches. Main stem straight, divided into fairly regular internodes, each of which ordinarily bears a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches alternate, rarely giving forth branchlets, divided into irregular internodes, each bearing several hydrothecæ. Hydrothecæ subalternate,

straight, the basal part being flask-shaped, and the distal portion tubular and not curving as in allied species, about the distal half free, and both upper and lower outlines of free portions concave; aperture oval, margin without definite teeth, although it is often more or less sinuous and sometimes with several reduplications; hydrothecæ directed forward, upward, and outward; operculum a single adcauline valve.

Gonosome.—Gonangia borne mostly in rows on upper sides of distal branches, small, ovoid, without neck; aperture obscurely polygonal, marked by four or five fine dark meridional lines giving the effect of radial canals on sessile medusæ.

Distribution.—*Albatross* Station 2841, lat. N. 54° 18′, long. W. 165° 55′, 56 fathoms; Station 3599, lat. N. 52° 5′, long. W. 177° 40′, 55 fathoms.

This fine sertularian differs materially from others of the genus in having the hydrothecæ standing out rigid and straight, without the gentle curve to the distal free portion that gives such grace to the other species of the genus *Abietinaria.* The margin is apt to be jagged and have the appearance of being toothed, but this is not constant. The medusa-like appearance of the gonangia is often quite striking. I take pleasure in naming this species after my friend, Mr. A. B. Alexander, whose long and faithful service on the U. S. Fish Commission steamer *Albatross* has done so much for the cause of deep-sea investigation.

Type slides.—Cat. No. 19819, 19820 U.S.N.M.; Cat. No. 18744, Museum of State University of Iowa; also in the collection of the author.

ABIETINARIA GREENEI (Murray).

(Plate XXXVI, figs. 1–8.)

Sertularia tricuspidata MURRAY, Ann. and Mag., 3d ser., V, 1860, p. 250.
Sertularia greenei MURRAY, Ann. and Mag., 3d ser., V, 1860, p. 504.
Cotulina greenei A. AGASSIZ, North American Acalephæ, 1865, p. 147.
Sertularia greenei CLARK, Hydroids of Pacific Coast, 1876, p. 257.
Sertularella greenei HARTLAUB, Revision der Sertularella-Arten, 1900, p. 14.
Sertularia greenei TORREY, Hydroida of Pacific Coast, 1902, p. 69.

Trophosome.—Colony a dense cluster of erect stems. Stem attaining a height of about 4 inches, not fascicled, slightly sinuous, with a few annulations at its base, with a double row of subopposite to subalternate hydrothecæ throughout its length, divided into very irregular internodes by straight nodes. Branches rather distant, alternate, erect, each with a deep constriction at its base, divided into irregular internodes, but distally with a tendency to a regular division, with a single pair of hydrothecæ to each internode. Branches often subdividing into alternate branchlets, and often ending in a dichotomous branching. Hydrothecæ subopposite to subalternate, flask-shaped, the free distal portion narrowing and curving upward so that the aperture is horizontal, margin varying from a perfectly round plain rim to the production of two strong teeth on the abcauline side. The operculum consists of a single adcauline flap.

Gonosome.—Gonangia borne on front of branches, conical to oblong-oval in shape, rather feebly but distinctly annulated throughout, ending in a short tubular collar and round aperture which is often surmounted by an acrocyst when the sexual products are mature.

Distribution.—Tomales Point, Monterey, Punta Reyes, San Francisco, and Santa Cruz (Clark); Vancouver Island (J. M. Dawson); Point Renfrew, Vancouver Island (Mrs. G. Gibbs).

This is a most puzzling species. It can not go into the genus *Sertularella*, as here defined, and the extreme variability of the marginal structures makes it difficult to decide whether it should go into *Thuiaria* or *Abietinaria.* The teeth, however, are not lateral, but abcauline, and often the margin is perfectly round, in which case we have the typical abietinarian structure. Both margins are found in every colony that I have examined, the smooth-rimmed hydrothecæ being more abundant in proximal parts of stem and branches, and those with teeth in the distal parts. Very rarely a three-toothed margin is seen. I am indebted to Mrs. G. Gibbs for excellent specimens from which the above description and the drawings were made.

ABIETINARIA COSTATA (Nutting).

(Plate XXXVI, figs. 9–12.)

Thuiaria costata Nutting, Hydroids of the Harriman Expedition, 1901, p. 187.

Trophosome.—Colony attaining a height of about 3 inches. Main stem straight, the proximal part unbranched and divided into regular internodes, each of which bears a pair of subopposite hydrothecæ, nodes oblique, the upper part of main stem divided into regular internodes, each of which bears a branch and two hydrothecæ on one side and a single hydrotheca on the other. Branches alternate, dichotomously branching several times so as to form a dense tuft; internodes unequal, each bearing several pairs of subalternate to subopposite hydrothecæ. Hydrothecæ resembling those of *A. filicula* and *A. inconstans*, as large as the latter, but not so thick and heavy, leaning forward so that their distal ends are not in the same plane with the branch; distal one-third free, constricted, narrowing to a round aperture, which points upward and often a little inward toward the stem; perisarc thickened on the inner wall just below the margin, furnishing the base of attachment for the one-flapped operculum. A chitinous thickening projects downward from the inner and lower corner of each hydrotheca.

Gonosome.—Gonangia very numerous, borne on both faces of the stem, and often on basal parts of branches, oblong-ovate, with a small tubular neck and round aperture, sides marked by about five meridional ridges, the crests of which are colored black, making a conspicuous marking.

Distribution.—Yakutat, Alaska (Nutting).

Although this species is doubtless allied to *A. inconstans*, it differs considerably in detail, being much less woody and heavy, and the branches subdividing to a much greater extent. The gonosome is quite distinct. The only specimens known were collected by the Harriman Alaska Expedition.

In its trophosome this species is quite similar to *A. coei* Nutting, but the gonosomes of the two are widely different, the longitudinally ribbed gonangia of the former being of a rare type in this genus.

Type slides.—Cat. Nos. 19907, 19908, U.S.N.M.; Cat. No. 18750, Museum of State University of Iowa; also in the collection of the author.

ABIETINARIA ANNULATA (Kirchenpauer).

(Plate XXXVI, figs. 13–15.)

Thuiaria annulata Kirchenpauer, Nordische Gattungen, 1884, p. 26.

Trophosome.—Colony about 4 inches high. Main stem and branches exceedingly thick and woody, black in color; the main branches spring from near base of stem, and the whole colony greatly resembles that of the plumularian *Nuditheca dalli* in general appearance and habit of growth. Stem and main branches straight, divided into irregular internodes, each of which bears several closely approximated and upward-directed branches each with an axillary hydrotheca; internodes with wide shallow and equidistant annulations, which in a general way correspond in number to the hydrothecæ on each side of the internode. Branches divided into irregular and distant internodes, each with several hydrothecæ on each side.

Hydrothecæ subopposite, very closely approximated, short, stout, tubular, with slightly constricted distal ends; margin even, aperture nearly round, and either horizontal or slightly inclined toward the stem. Operculum of one flap attached to adcauline side of margin.

Gonosome.—Not known.

Distribution.—The original description was taken from a specimen without a label indicating locality. The above description is from a specimen in the U. S. National Museum, *Albatross* Station 3546, lat. N. 54° 12′, long. W. 165° 42′, 36 fathoms.

This species has an exceedingly thick and coarse annulated stem that at once distinguishes it from any other *Abietinaria* that I have seen.

Type.—In Leipsic Museum.

ABIETINARIA TURGIDA (Clark).

(Plate XXXVII, figs. 1, 2.)

Thuiaria turgida CLARK, Alaskan Hydroids, 1876, p. 229.
Thuiaria turgida KIRCHENPAUER, Nordische Gattungen, 1884, p. 21.
Thuiaria turgida NUTTING, Hydroids from Alaska and Puget Sound, 1899, p. 741.
Thuiaria turgida NUTTING, Hydroids of the Harriman Expedition, 1901, p. 186.

Trophosome.—Colony attaining a height of about 8 inches. Stem rather stout, glazed, divided into short stout regular internodes by oblique nodes, each internode bearing a pair of subopposite hydrothecæ. Main branches irregularly alternate and few in number, originating from distal part of stem, constricted near point of attachment, and resembling the main stem in their proximal portion, while distally they give origin to alternate branchlets, one being borne on each internode of the branch. Branches dichotomously dividing, with very long internodes divided by oblique nodes. Hydrothecæ subopposite, tubular, almost wholly immersed, distal end but slightly constricted, terminating in a round margin pointing obliquely outward and upward; the top of one hydrotheca usually reaching just to the base of the next one above. Operculum of a single flap attached to the adcauline side of margin.

Gonosome.—Gonangia large, oblong-ovate, attached to the bases of the branchlets so as to form a densely set double row on the front of the branches. There is a short collar, round terminal aperture, and operculum. Sides of gonangia ornamented with stout longitudinal ridges, three to five in number.

Distribution.—Abundant throughout the Alaskan coasts and Aleutian Islands and Bering Sea. All of the specimens known were collected either by Dr. Dall and party (Clark), or the Harriman Alaska Expedition (Nutting).

This species is most like *A. gigantea* (Clark), but the hydrothecæ are much smaller and more crowded than in the latter species, and the gonangia are quite different.

Type.—In the collection of the U. S. National Museum.

ABIETINARIA GIGANTEA (Clark).

(Plate XXXVII, figs. 3–5.)

Thuiaria gigantea CLARK, Alaskan Hydroids, 1876, p. 230.
Thuiaria gigantea KIRCHENPAUER, Nordische Gattungen, 1884, p. 21.
Thuiaria gigantea NUTTING, Hydroids from Alaska and Puget Sound, 1899, p. 741.
Thuiaria gigantea NUTTING, Hydroids of the Harriman Expedition, 1901, p. 186.

Trophosome.—Colony attaining a height of about 8 inches in the largest specimen examined. Stem undivided, with very distant and irregularly placed nodes and two rows of hydrothecæ along its entire length. Branches irregularly alternate, constricted at their origins, occasionally bearing one or more branchlets, with no nodes or one or two very distant ones, and bearing close-set rows of hydrothecæ on opposite sides. Hydrothecæ very large and stout, immersed almost to their margins, and with a distinct bare space on the internode between the top of one and the bottom of the next one above; margins elliptical, the horizontal axes being the longer, and sinuous on lateral aspect, giving the appearance of a medium blunt tooth above. Operculum with a single adcauline flap.

Gonosome.—Gonangia comparatively small, borne in dense double rows along the upper sides of the branches, oblong-ovate, with large terminal round aperture and without collar or longitudinal ridges.

Distribution.—Alaskan shores and Aleutian Islands, Bering Sea, Hagmeister Island, Akutan Pass, Kyska Harbor (Clark); Orca and Kadiak, Alaska (Nutting); Belkoffsky (Dall); *Albatross* Station 2864, lat. N. 48° 22′, long. W. 122° 51′, 48 fathoms; Station 3464, lat. N. 48° 14′, long. W. 123° 20′ 40″, 40 fathoms; Station 3546, lat. N. 54° 12′, long. W. 162° 42′, 36 fathoms; Station 3557, lat. N. 57° 04′, long. W. 170° 24′, 26 fathoms.

Type.—In the collection of the U. S. National Museum.

HYDRALLMANIA Hincks (modified).

Trophosome.—Hydrothecæ in groups all on one side of the branches, their bases aligned and closely approximated, their distal ends bent alternately to the right and left. Operculum apparently of a single adcauline flap.

Gonosome.—Gonangia oblong-ovoid, without lateral spines or marsupium; aperture large, round.

This is a perfectly well marked genus, consisting of a few species that agree in the peculiar position of the hydrothecæ and in the special character of the alternate flexing of their distal ends to right and left when viewed from the front. The only species known at the time preceding Hincks's great work had been for a long time placed in the genus *Plumularia* by many authors. The absence of the sarcostyle was sufficient to differentiate it from the family Plumularidæ, and other characters served to settle its affinities with the Sertularidæ.

Since the genus was instituted by Hincks in 1868[1] it has been recognized by practically every writer that has discussed it or had occasion to mention the type species. Mr. Paarmann, who carefully investigated the opercula of this and other Sertularidæ, found that the operculum consists of a single functional adcauline flap, and that the margin was produced into a stationary "collar" on the adcauline side.

KEY TO THE AMERICAN SPECIES OF THE GENUS HYDRALLMANIA.

Hydrothecæ distinctly flask shaped, distal ends much constricted, aperture round .... *franciscana.*
Hydrothecæ more nearly tubular, distal ends not distinctly constricted and not round.
  Each hydrotheca in a group reaching above the middle of the one next above it .... *falcata.*
  Each hydrotheca in a group not attaining the level of the middle of the next one above .... *distans.*

HYDRALLMANIA FALCATA (Linnæus).

(Plate XXXVIII, figs. 1–4.)

Sickle Coralline Ellis, Essay Nat. Hist. Corallines, 1755, p. 12.
Sertularia falcata Linnæus, Systema Naturæ, 1758, p. 810.
Sertularia stipulata Linnæus, Systema Naturæ, 1758, p. 813.
Sertularia falcata Linnæus, Systema Naturæ, 1761, p. 541.
Sertularia falcata Houttuyn, Natuurlyke Historie, XVII, 1761–1773, p. 546.
Sertularia falcata Pallas, Elenchus Zoophytorum, 1766, p. 144.
Sertularia falcata Linnæus, Systema Naturæ, 12th ed., 1767, p. 1309.
Sertularia falcata Boddaert (Pallas), Lyst der Plant-Dieren, 1768, p. 180.
Sertularia falcata Maratti, De Plantis Zoophytis, 1776, p. 30.
Sertularia falcata Gronovius, Zoophylacium gronovianum, 1781, p. 359.
Sertularia falcata Ellis and Solander, Nat. Hist. Zooph., 1786, p. 42.
Sertularia falcata Wilkins and Herbst (Pallas), Charakteristik der Thierpflanzen, 1787, p. 183.
Sertularia falcata Gmelin, Systema Naturæ, 13th ed., 1788, p. 3849.
Plumularia falcata Esper, Die Pflanzenthiere in Abbildungen, III, 1788–1830, p. 224.
Sertularia falcata Berkenhout, Synops. Nat. Hist. Great Britain, I, 1789, p. 217.
Sertularia falcata Esper, Fortsetzungen der Pflanzenthiere, II, 1794–1806, pl. II.
Sertularia falcata Bosc, Hist. nat. des Vers, III, 1802, p. 95.
Sertularia falcata Turton, British Fauna, 1807, p. 213.
Sertularia falcata Jameson, Cat. Anim. Class Vermes, 1811, p. 564.
Pennaria (Sertularia) falcata Oken, Lehrbuch der Naturgeschichte, 1815, p. 94.
Plumularia falcata Lamarck, Hist. nat. des anim. sans Vert., 1816, p. 125.
Aglaophenia falcata Lamouroux, Hist. nat. des Polypiers, 1816, p. 174.
Sertularia falcata Stewart, Elements Nat. Hist. Anim. Kingd., II, 1817, p. 443.
Sertularia falcata Schweigger, Handbuch der Naturgeschichte, 1820, p. 427.
Plumularia falcata Fleming, British Animals, 1828, p. 546.
Sertularia falcata Bosc, Hist. nat. des Vers, 1830, p. 110.
Plumularia falcata Johnston, Trans. Newcastle Society, II, 1832, p. 259.
Plumularia falcata de Blainville, Manuel d'Actinologie, 1834, p. 477.

[1] British Hydroid Zoophytes, 1868, p. 273.

Sertularia falcata OKEN, Allgemeine Naturgeschichte, 1835, p. 79.
Plumularia falcata LAMARCK, Hist. nat. des anim. sans Vert., 2d ed., II, 1836, p. 160
Plumularia falcata COUCH, Cornish Fauna, III, 1838, p. 30.
Plumularia falcata HASSALL, Ann. and Mag., VI, 1841, p. 169.
Plumularia falcata MACGILLIVRAY, Ann. and Mag., IX, 1842, p. 464.
Plumularia falcata HYNDMAN, Ann. and Mag., X, 1842, p. 20.
Sertularia (Plumularia) falcata DALYELL, Rare and Remarkable Animals of Scotland, 1847, p. 176.
Plumularia falcata JOHNSTON, British Zoophytes, 2d ed., 1847, p. 90.
Plumularia falcata STIMPSON, Marine Invert. Grand Manan, 1854, p. 8.
Plumularia falcata PACKARD, Canadian Naturalist, Dec., 1863, p. 4.
Sertularia falcata A. AGASSIZ, North American Acalephæ, 1865, p. 144.
Plumularia falcata VAN BENEDEN, Fauna littorale de Belgique, 1866, p. 187.
Hydrallmania falcata HINCKS, British Hydroid Zoophytes, 1868, p. 273.
Hydrallmania falcata VERRILL, Invert. Vineyard Sound, 1871–72, p. 408.
Hydrallmania falcata G. O. SARS, Bidrag til Kundskaben, 1873, p. 18.
Hydrallmania falcata VERRILL, Proc. Am. Assn. Adv. Sci., 1873, p. 364.
Hydrallmania falcata SCHULZE, Nordsee Exped., 1874, p. 132.
Hydrallmania falcata MCINTOSH, Ann. and Mag., 4th Ser., XIII, 1874, p. 214.
Hydrallmania falcata VERRILL, Amer. Journ. Sci. and Arts, VII, 1874, p. 44.
Hydrallmania falcata WINTHER, Naturhist. Tidsskrift., 1880, p. 251.
Hydrallmania falcata BERGH, Goplepolyper fra Kara Havet, 1887, p. 337.
Hydrallmania falcata DREISCH, Tektonische Studien, 1890, p. 209.
Hydrallmania falcata MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 235.
Hydrallmania falcata LEVINSEN, Vid. Udb. "Hauchs.", Togter, 1893, p. 387.
Hydrallmania falcata CRAWFORD, Ann. and Mag., 6th ser., XVI, 1895, p. 261.
Hydrallmania falcata HARTLAUB, Hydromedusen Helgolands, 1897, p. 451.
Hydrallmania falcata BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 88.
Hydrallmania falcata NUTTING, Hydroids of the Woods Hole Region, 1901, p. 364.
Hydrallmania falcata HARGITT, American Naturalist, 1901, p. 392.
Hydrallmania falcata HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 355.
Hydrallmania falcata WHITEAVES, Marine Invert. Eastern Canada, 1901, p. 27.
Hydrallmania falcata SÆMUNDSSON, Bidrag islandske Hydroider, 1902, p. 63.
Hydrallmania falcata TORREY, Hydroida of the Pacific Coast, 1902, p. 13.

Trophosome.—Colony when typically developed assuming an exceedingly graceful panicled form, and attaining a height of a foot or more. Main stem not fascicled, spirally twisted, destitute of hydrothecæ, divided into irregular internodes, the tendency being to bear a branch to each internode, but there is an occasional intermediate internode. Branches arranged in a more or less regular spiral, and themselves giving forth regularly alternate branchlets which occupy two planes which meet the branch at nearly a right angle. Branches and branchlets bearing hydrothecæ and divided into rather irregular internodes, each of which bears a number of hydrothecæ. Hydrothecæ tubular, arranged in groups on front of branches and branchlets, their bases in line, their distal portions bending gracefully to the right and left alternately, as viewed from above, the top of one reaching above the middle of the next one above, directed upward and forward as viewed from the side. Aperture oval or lunate, the side of margin nearest stem being flattened; operculum consisting of a single flap.

Gonosome.—Gonangia borne usually on distal parts of branches and proximal parts of branchlets, ovate, with several indistinct longitudinal lines or ribs, ending in a short tubular neck and round aperture.

Distribution.—Very abundant in rather shallow water on New England coast; Labrador (Packard); Grand Manan (Stimpson); British coasts (Allman); Belgium (van Beneden); Norway (Sars); Helgoland (Hartlaub); Polar Sea (Bergh); Iceland (Sæmundsson); Denmark (Winther).

Although usually found in shallow water, this species was found at a depth of 1,100 fathoms by the Norwegian North Atlantic Expedition (Bonnevie).

HYDRALLMANIA DISTANS Nutting.

(Plate XXXVIII, figs. 5–9.)

Hydrallmania falcata Calkins, Hydroids from Puget Sound, 1899, p. 362.
Hydrallmania distans Nutting, Hydroids from Alaska and Puget Sound, 1899, p. 746.
Hydrallmania distans Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 355.
Hydrallmania distans Torrey, Hydroida of the Pacific Coast, 1902, p. 70.

Trophosome.—Colony of erect, straggling habit, attaining a height of about 6 inches. Stem not fascicled, spirally twisted, slender, wiry, divided into irregular, usually long internodes, the tendency being to have a branch on each internode. Branches distant, spirally inserted in full-grown specimens, irregularly alternate in young specimens, borne on processes from the stem in the axils of which a hydrotheca is often, not always, found; divided into branchlets which are regularly alternate and divided into regular internodes each of which bears three hydrothecæ on its anterior or upper face, and a branchlet; branchlets divided into irregular internodes, each of which bears from two to six (usually four) hydrothecæ on its upper side. Hydrothecæ tubular, flattened, not noticeably gibbous below, inserted in a line on the upper sides of branches, their distal portions bending gracefully to the right and left alternately, the top of one not reaching to the middle of the one immediately above it; margin much flattened, the corners angulated; aperture a much flattened oval or crescent. Operculum of a single abcauline flap.

Gonosome.—(Not heretofore described.) Gonangia borne on front of branch, broadly ovate, flattened, with a wide aperture, distinct pedicel, and apparently without the meridional lines seen in *H. falcata.*

Distribution.—Puget Sound (Nutting). Dredged by the Young Naturalists' Society.

Since this species was originally described I have obtained additional material through the kindness of Prof. Trevor Kincaid, and have very carefully compared it with specimens of *H. falcata* from Plymouth, England, with the result of confirming me in the opinion that the differences pointed out before are quite constant, and that *H. distans* is a good species. The shape of the hydrothecæ of *H. franciscana*, as described and figured, is constantly different from that of *H. distans*, being flask-shaped and twice as broad in the gibbous lower portion as at the aperture. But a single gonangium has been found, and it is possible that it may have been flattened artificially, making the figure misleading.

Type slides.—Cat. No. 19808, U. S. N. M.' Cat. No. 18732, Museum of the State University of Iowa; also in the collection of the author.

HYDRALLMANIA FRANCISCANA (Trask).

(Plate XXXVIII, fig. 10.)

Plumularia franciscana Trask, Proc. Cal. Acad. Sci., I, 1857, p. 113.
Plumularia gracilis Murray, Ann. and Mag., 3d ser., V, 1860, p. 251.
Sertularia gracilis Agassiz, North American Acalephæ, 1865, p. 145.
Hydrallmania franciscana Clark, Hydroids of Pacific Coast, 1876, p. 260.
Hydrallmania franciscana Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 355.
Hydrallmania franciscana Torrey, Hydroida of the Pacific Coast, 1902, p. 13.

"Polypodom 6 or 8 inches high, color corneous, alternately branched, the branches pinnated, one branch to each internode of the stem. The pinnæ rise one above the other, are pointed, and support three cells at each joint. On two specimens four cells have been met with, but may be regarded as an exception rather than otherwise. The pinnæ are dichotomously branched in adult specimens. Cells laginculate, smooth, free, slightly decumbent; the attachment of the base is marked by a slightly elevated rounded rim; apertures round and smooth."

"Bay of San Francisco, among rejectimenta of the beach."

I have not seen this species, and have here inserted the original description.

Plumularia gracilis Murray is doubtless the same species as *H. franciscana*, as Doctor Clark concludes. If the character given by Murray, three cells at each joint, is at all constant, the author can not regard *H. franciscana* as a synonym of *H. falcata*, in which the average is

uniformly much higher. Both Murray and Trask speak of the hydrothecæ being supported by a sort of triangular buttress (Murray), or a slightly elevated rounded rim (Trask).[1] Murray adds that the gonangia are oblong-oval.

SELAGINOPSIS Allman (modified).

Trophosome. Hydrothecæ arranged in more than two longitudinal series, at least on distal parts of branches, or in two or more series each of which has the distal ends of the hydrothecæ turned alternately to the right and left. Operculum of a single abcauline flap. Internodes long or absent.

Gonosome.—Gonangia usually obovate, without internal marsupium or external ornamentation.[2]

This definition of the genus is more comprehensive than the original by Allman.[3] This writer proposed two new genera at the same time, *Selaginopsis* to include forms with several rows of hydrothecæ set on simple branches, and *Pericladium* to include forms with several rows of hydrothecæ set on bifurcating ramuli. In 1878 Mereschkowsky, without having seen Allman's paper, proposed the genus *Polyserias* to include sertularians with hydrothecæ arranged in several rows on the branches, but which are biserial on the stem. Later, but during the same year, he wrote another paper[4] in which he acknowledged the priority of Allman's generic name *Selaginopsis*, but proposes to include in that genus the forms that Allman put in *Pericladium*. A little later, 1890, Marktanner-Turneretscher[5] recognized the genus substantially as defined by Mereschkowsky. In 1893 Levinsen[6] in pursuance of his policy of relying entirely on the characters of the hydrothecal margin and operculum, included the species here considered as belonging to *Selaginopsis* in the genus *Thuiaria*, on account of the single-flapped abcauline operculum.

The genus *Selaginopsis* as above defined seems to me to be a perfectly tenable group, indeed one of the best genera in the family Sertularidæ. Its affinities are evidently with *Thuiaria*, from which, however, it is sharply differentiated by the arrangement of the hydrothecæ.

There are no points of intergradation between this genus and others that need offer any difficulties in the allotment of species to this genus as here defined. In most species the hydrothecæ of the stem are arranged in two opposite series, as in *Thuiaria*, and in some cases this is true of the proximal parts of branches. But in these same species the hydrothecæ on all but the proximal parts of the branches are polyserial, furnishing a perfectly evident character for generic identification.

KEY TO AMERICAN SPECIES OF THE GENUS SELAGINOPSIS.

The hydrothecæ in a given row not turning alternately to right and left.
  Distal ends of hydrothecæ distinctly exserted.
    Margin with two distinct teeth .... *mirabilis.*
    Margin without teeth .... *pinaster.*
  Distal ends of hydrothecæ not greatly exserted.
    Hydrothecæ in three rows .... *triserialis.*
    Hydrothecæ in four rows.
      Stem and branches geniculate, branching regularly compound .... *plumiformis.*
      Stem and branches not geniculate, branches not regularly compound:
        Two pairs of branches to each internode of stem .... *cedrina.*
        Stem very heavy and woody. Nodes deep, accompanied by annulations .... *pinnata.*
        Cœnosarcal canals in branches very regular and four in number. Gonangia with numerous very long curved processes .... *ornata.*

[1] Annals and Magazine, 3d ser., V, pl. XII, fig. 1*a*, represents each internode of the branch as bearing three hydrothecæ, in one case two, which confirms Trask's description and figure.

[2] The known exceptions among American species are *S. ornata* and *S. cedrina.*

[3] Journal of the Linnæan Society, Zoology, XII, 1874, p. 272.

[4] New Hydroida from Ochotsk, Kamtschatka, and other parts of the North Pacific Ocean, Annals and Magazine of Natural History, 5th ser., II, 1878, p. 434.

[5] Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 242.

[6] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, p. 193.

Hydrothecæ normally in more than four rows.
Hydrothecæ in four or six rows .... *cylindrica.*
Hydrothecæ in six or eight rows.. *obsoleta.*
Hydrothecæ in rows, distal ends turning alternately to the right and left as in *Hydrallmania.*
Hydrothecæ in four rows .... *hartlaubi.*
Hydrothecæ in two rows .... *alternitheca.*

SELAGINOPSIS MIRABILIS (Verrill).

(Plate XXXVIII, figs. 11–12.)

Diphasia mirabilis VERRILL, Amer. Journ. Sci., 3d ser., V, 1872, p. 9.
Diphasia mirabilis VERRILL, Trans. Conn. Acad. Arts and Sci., III, Pt. 1, 1875, p. 53.
Diphasia mirabilis CLARK, Alaskan Hydroids, 1876, p. 219.
Polyserias hincksii MERESCHKOWSKY, Ann. and Mag., 4th ser., XX, 1877, p. 228.
Selaginopsis mirabilis NORMAN, Ann. and Mag., 5th ser., I, 1878, p. 335.
Selaginopsis mirabilis MERESCHKOWSKY, Ann. and Mag., 5th ser., II, 1878, p. 445.
Selaginopsis mirabilis KIRCHENPAUER, Nordische Gattungen, 1884, p. 12.
Selaginopsis mirabilis BERGH, Goplepolyper fra Kara Havet, 1887, p. 337.
Sertularia mirabilis LEVINSEN, Vid. Meddel. naturh. Foren., 1893, p. 191.
Selaginopsis mirabilis BONNEVIE, Norwegische Hydroiden, 1898, p. 12.
Selaginopsis mirabilis NUTTING, Hydroids from Alaska and Puget Sound, 1899, p. 741.
Selaginopsis mirabilis BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 85.
Selaginopsis mirabilis HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 355.
Selaginopsis mirabilis TORREY, Hydroida of Pacific Coast, 1902, p. 70.
Sertularia mirabilis SÆMUNDSSON, Islandske Hydroider, 1902, p. 63.

Trophosome.—Colony plumose, attaining a height of 4 or 5 inches. Stem thick, not fascicled, sinuous or weakly geniculate, without nodes for the most part, although an occasional one is to be seen. A row of hydrothecæ on opposite sides of the stem, there being three between adjacent branches. Branches alternate, occasionally dividing into branchlets, with a shallow node dividing them from the stem process on which they are borne and which bears two opposite hydrothecæ on the proximal side of the node. Ordinarily there are no other nodes. Hydrothecæ in six series, immersed for only about half their length, the distal portion curving outward and ending in an oval margin with two pronounced lateral teeth. Operculum of two valves or flaps.

Gonosome.—Gonangia borne on the branches, obconic when young, when mature oval, and having a very broad, round terminal aperture.

Distribution.—La Have Bank, Nova Scotia (Verrill); Hagmeister Island, Bering Sea (Clark); Popoff Straits, Shumagin Islands (Clark); Puget Sound (Nutting). White Sea and Polar Sea, 60 fathoms (Mereschkowsky); Polar Sea (Bergh); Norwegian Coast (Bonnevie); West Coast Greenland (Levinsen); Iceland (Sæmundsson); *Albatross* Station 2599, lat. N. 34° 45′ 20″, long. W. 75° 38′ 10″, 25 fathoms; Station 2865, lat. N. 48° 12′, long. W. 122° 49′, 40 fathoms.

This is a very well-marked species, and the only one of the genus that I have seen with hydrothecæ on the process that bears the branches.

Type.—In the collection of the U. S. National Museum?

SELAGINOPSIS PINASTER (Lepechin).

(Plate XXXVIII, fig. 13.)

Sertularia pinaster LEPECHIN [1], Acta Acad. Petropolitanæ, 1783, p. 223.
Sertularia pinus GMELIN, Systema Naturæ, Linnæus, 1788, p. 3846.
Sertularia pinus BOSC, Hist. Nat. des Vers, III, 1802, p. 93.
Sertularia pinaster LAMOUROUX, Hist. des Polypiers, 1816, p. 197.
Sertularia pinus KIRCHENPAUER, Nordische Gattungen, 1884, p. 11.

"Danach erheben sich aus krieschenden Wurzelfasern, meist einfache, suweilen unten geteilte cylindrische Stämmchen bis 6 Zool hoch. Sie sind bis gegen die Mitte ihrer Höhe dunkel-braun,

[1] The name *Sertularia pinaster* was used for another species, now *Diphasia pinaster* (Ellis and Solander), and was in general use at the time that Gmelin prepared the thirteenth edition of the Systema Naturæ (1788). The *Sertularia pinaster* of Lepechin was not then generally known, and Gmelin retained the name for the *Sertularia pinaster* of Ellis and Solander, giving a new name, *S. pinus*, to Lepechin's species. The law of priority, however, makes it necessary to retain the name *Sertularia pinaster* for Lepechin's species.

werden aber nach oben zu heller und sind unregelmassig gefiedert. Die Fiedern sind fädlich, schlaff und mit mehreren, oft 6 Reihen von Hydrotheken besetzt. Diese sind eiförmig, sind aber oben mit einem vorragenden Hals versehen, auf welchem sich die Mundöffnung befindet. Die Gonotheken sind schlauchartig (utriculares), meistens angeschwollen, fast durchsichtig, haben eine runde, von einem wulstigen Rand umgabene Öffnung und sitzen oft zu beiden Seiten der Zweige, dicht gedrängt, fast dachziegelförmig."

Distribution.—Siberian Polar Sea (Lepechin); St. Paul's Island (A. and A. Krause).

The identity of this species is doubtful. The foregoing description is quoted entire from Kirchenpauer and is the only good description that I can find. Kirchenpauer bases his description on a fragmentary specimen found in the collection made by A. and A. Krause in Bering Sea. His drawing, which I have copied, shows an irregularity in the distribution of hydrothecæ, which are represented as not in regular vertical series, not found in other species of the genus.

Otherwise it would seem likely that *S. pinaster* and *S. cylindrica* Clark were identical. It does not seem likely that *S. pinaster* is the same as *Pericladium bidentatum*, as suggested by Kirchenpauer, the latter species having well-marked lateral hydrothecal teeth, which are not indicated in Kirchenpauer's description or drawing of *S. pinus*.

SELAGINOPSIS TRISERIALIS Mereschkowsky.

(Plate XXXIX, figs. 1–2.)

Selaginopsis triserialis MERESCHKOWSKY, Ann. and Mag., 5th ser., II, 1878, p. 435.
Selaginopsis triserialis KIRCHENPAUER, Nordische Gattungen, 1884, p. 14.
Sertularia incongrua TORREY, Hydroida of the Pacific coast, 1902, p. 69.

Trophosome.—Colony attaining a height of about 2 inches. Stem straight, with distant and irregular nodes, and two rows of completely immersed hydrothecæ on opposite sides. Branches with a pinnate appearance, but really arranged in an open spiral, borne on short processes from the stem that do not bear hydrothecæ, with very distant nodes or none. Hydrothecæ in two rows on proximal portion and in three rows on distal portion of each branch, where they also follow a spiral arrangement, more distant from each other than is common in the genus, there being often a considerable space between successive hydrothecæ and also between the rows, almost entirely immersed, only a very short moiety of the distal end being free; aperture nearly round, without teeth or noticeable angles; operculum a single adcauline flap.

Gonosome.—A single distorted gonangium was present in the specimen described; oblong-oval in shape, with a large terminal aperture. I believe it has not been described before.

Distribution.—Kamchatka (M. Kastilsky); San Pedro, California (Torrey); *Albatross* Station 2908, lat. N. 34° 25′ 25″, long. W. 120° 20′, 31 fathoms.

This is the most southern locality for this genus on the Pacific coast. Torrey regards this form as showing an intergradation between *Thuiaria* and *Selaginopsis*. Several species of *Selaginopsis*, however, have but two rows of hydrothecæ on the proximal part of the branches, the other rows being intercalated distally.

Type.—In the collection of the Academy of Sciences, St. Petersburg.

SELAGINOPSIS PLUMIFORMIS, new species.

(Plate XXXIX, fig. 3.)

Trophosome.—Colony branching in a regular symmetrical compound manner, and attaining a height of about 4 inches. Stem regularly geniculate, irregularly annulated in proximal portion, divided into very irregular internodes by distant nodes, with a row of immersed hydrothecæ on each side. Primary branches alternate, borne on short processes from the stem, there being three hydrothecæ on the stem between adjacent processes; a very short basal internode intervenes between this process and the first hydrotheca of a branch; otherwise there are no regular internodes, the primary branches resembling the main stem in all particulars and bearing a row of immersed hydrothecæ on each side. Secondary branches regularly alternate,

borne on processes from the primary branches, not divided into internodes. Hydrothecæ in four equidistant rows, tubular, larger below, almost completely immersed, margin oval, compressed into angles at the sides, the bottom of one hydrotheca usually being below the level of the top of the one below it. Operculum of a single abcauline flap.

Gonosome.—Not known.

Distribution.—The only specimen known was found in the United States National Museum collection, labeled lat. N. 60° 22′, long. W. 168° 45′, Lieut. George N. Stoney, U. S. Navy.

This species almost exactly agrees with *S. pacifica* Mereschkowsky in the shape and disposition of the hydrothecæ, but differs strikingly in the mode of branching, being the only *Selaginopsis* that I have seen with true compound branching in which the stem, primary branches and secondary branches bear the relations to each other that we find in the shaft barb and barbules of a feather.

Type slides.—Cat. No. 19816, U. S. N. M. Cat. No. 18740, Museum of the State University of Iowa; also in the collection of the author.

SELAGINOPSIS CEDRINA (Linnæus).

Sertularia cedrina Linnæus, Systema Naturæ, 1758, p. 814.
Sertularia cedrina Houttuyn, Natuurlyke Hist., XVII, 1761–73, p. 577.
Sertularia cedrina Pallas, Elenchus Zoophytorum, 1766, p. 139.
Sertularia cedrina Linnæus, Systema Naturæ, 1767, p. 1313.
Sertularia cedrina Boddaërt, Lyst der Plant-Dieren, 1768, p. 173.
Sertularia cedrina Wilkins and Herbst, Charakteristik der Thierpflanzen, 1787, p. 177.
Sertularia cedrina Gmelin, Systema Naturæ, (Linnaeus), 1788–93, p. 3857.
Sertularia cedrina Bosc, Hist. Nat. des Vers, III, 1802, II, p. 100.
Nigellastrum (*Sertularia*) *cedrina* Oken, Lehrbuch der Naturgeschichte, 1815, p. 93.
Sertularia cedrina Lamouroux, Hist. des Polypiers, 1816, p. 196.
Selaginopsis pacifica Mereschkowsky, Ann. and Mag., 5th ser., II, 1878, p. 438.
Selaginopsis cedrina Kirchenpauer, Nordische Gattungen, 1884, p. 8.

"*Trophosome.*—Hydrocaulus slightly curved, divided into regular internodes. Branches arranged alternately on two sides of the principal stem, two pairs on each internode, divided into five internodes, constricted at the point of attachment and at the internodes. Each branch bears one or two, rarely five, secondary branches. Hydrothecæ cylindrical, almost entirely immersed in the substance of the axial tube; aperture oval, with two angles (not teeth); hydrothecæ arranged in four regular series, and at the same time in a spiral, the hydrothecæ of each series following one another immediately without leaving any free space or interval.

"*Gonosome.*—Gonangia arranged in two or three series, of an oval form, narrowing gradually toward the base, and truncate at the apex. The surface is ribbed."

Distribution.—Kamchatka (Linnæus); Metschigman Bay (Mereschkowsky); India Point, Bering Sea (Kirchenpauer).

I have not seen this species, and have copied the most complete description that I could find, that of Mereschkowsky. Kirchenpauer[1] presents such strong evidence that the *S. pacifica* of Mereschkowsky is identical with *Sertularia cedrina* Linnæus that I have here conformed to his view.

SELAGINOPSIS PINNATA Mereschkowsky.

(Plate XXXIX, fig. 6.)

Selaginopsis pinnata Mereschkowsky, Ann. and Mag., 5th ser., II, 1878, p. 436.
Selaginopsis pinnata Kirchenpauer, Nordische Gattungen, 1884, p. 14.

Trophosome.—Colony pluniform, attaining a height of about 6 inches. Stem not fascicled, but very heavy and woody, divided into internodes which are fairly uniform in length on proximal portion and less so on distal portion; nodes very deeply cut, each accompanied by two or more regular annulations; stem bearing two opposite rows of hydrothecæ and two opposite rows of branches. Branches borne on very short processes of the stem, and very deeply constricted at

[1] Nordische Gattungen und Arten, 1884, pp. 8 and 9.

the proximal node, those on the two sides of the stem apparently not arranged with any reference to each other, being sometimes opposite and sometimes subopposite, subalternate or alternate; no nodes. Hydrothecæ in four series forming regular vertical rows, those in a given row being separated by about one-fourth their length, the four series being placed so that not only a vertical but also a spiral arrangement of hydrothecæ can be traced; individual hydrothecæ rather short and stout, broader below, with a bracket-shaped chitinous thickening at the bottom, and an oval aperture which sometimes shows slight angles at the sides; operculum a single abcauline flap.

Gonosome.—Not known.

Distribution.—Port Ajan (M. Wosnessensky); St. Pauls Island, 23 fathoms (Kirchenpauer); *Albatross* Station 3558, lat. N. 56° 58′, long. W. 170° 09′, 25 fathoms.

The specimen from Station 3558 answers quite exactly to the original description of Mereschkowsky, except that the arrangement of the branches seems less regular than his description would indicate. The color of the colony is light brown, lightening on distal parts to a brownish buff.

Type.—In the collection of the Academy of Sciences, St. Petersburg.

SELAGINOPSIS ORNATA, new species.

(Plate XL, figs. 1–3.)

Trophosome.—Colony plumose, attaining a height of about 4½ inches. Stem, straight, thick, more attenuated in proximal portion, divided into irregular internodes by usually distant nodes; cœnosarc canaliculated. Branches on opposite sides of stem and borne on short and inconspicuous processes, irregular in disposition, being either opposite or alternate, closely approximated, there being regularly but two hydrothecæ between adjacent branches; cœnosarc of branches very regularly canaliculated, there being four canals running through each branch, each canal supplying a row of hydrothecæ; branches not divided into internodes, but themselves often branching to form terminal branchlets. Hydrothecæ in four regular and equidistant rows, and also in spirals, cylindrical, almost entirely immersed, nothing but the margins being free; aperture oval, nearly round, with shallow lateral teeth and evident sinuations; operculum a single abcauline flap. The top of one hydrotheca does not reach quite to the bottom of the one above.

Gonosome. Gonangia borne in rows on front of branches, each being inserted just below the base of an hydrotheca, obconical, long, produced into a rather slender pedicel below, and bearing about eight remarkably long, bifurcated arms or processes above, which curve inward toward each other at their distal ends so as to form a sort of pseudo-marsupium above the body of the gonangium.

Distribution.—*Albatross* Station 2843, lat. N. 53° 56′, long. W. 165° 56′, 45 fathoms.

In its trophosome this species is closely allied to *S. pinnata*, from which it differs in the regular arrangement of cœnosarcal canals in the branches and also in having but two hydrothecæ between adjacent branches.

Type slides.—Cat. No. 19814, U.S.N.M. Cat. No. 18738, Museum of the State University of Iowa; also in the collection of the author.

SELAGINOPSIS CYLINDRICA (Clark).

(Plate XXXIX, figs. 7–8.)

Thuiaria cylindrica Clark, Alaskan Hydroids, 1876, p. 226.
Selaginopsis cylindrica Mereschkowsky, Ann. and Mag., 5th ser., II, 1878, p. 445.
Selaginopsis cylindrica Kirchenpauer, Nordische Gattungen, 1884, p. 12.
Thuiaria cylindrica Murdoch, Expedition to Point Barrow, 1885, p. 166.
Selaginopsis cylindrica Marktanner-Turneretscher, Hydroiden Hofmuseums, 1890, p. 243.
Selaginopsis cylindrica Calkins, Some Hydroids from Puget Sound, 1899, p. 362.
Selaginopsis cylindrica Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 354.

Trophosome.—Colony attaining a height of about 5 inches, plumose. Stem slender basally, enlarging distally, internodes long and irregular, regularly geniculate, a row of hydrothecæ on

opposite sides. Branches alternate, borne on short, thick processes from the stem, sometimes unbranched, often dividing once and occasionally bearing regularly alternate branches, as does the stem; nodes very distant or absent. Hydrothecæ tubular, arranged in four rows on proximal parts of branches and in six (rarely eight) rows on distal parts, closely approximated, entirely immersed, narrowing toward the distal curved portion and ending in a smooth toothless margin and oval aperture; operculum a single abcauline valve. The number of rows on a branch is suddenly increased from four to six by the intercalation of two new rows between the old ones.

Gonosome.—Unknown.

Distribution.—Port Moller, Alaska; Hagmeister Island, Bering Sea; Chirikoff Island, Chiachi Islands (Clark), Puget Sound (Calkins), Bristol Bay, Alaska (collected by C. L. McKay), Arctic Ocean (Murdoch). Depth ranging from the shore line to 17 fathoms.

This appears to be a well-marked species, about which there has been little difference of opinion. It is the one most abundant on the North Pacific coast.

Type.—In the collection of the U. S. National Museum.

SELAGINOPSIS OBSOLETA (Lepechin).

(Plate XXXIX, figs. 4, 5; XL, fig. 4.)

Sertularia obsoleta LEPECHIN, Acta Acad. Petropol., II, 1778, Pt. 2, p. 137.
Sertularia obsoleta GMELIN, Systema Naturæ (Linnæus), 1788–1793, p. 3846.
Sertularia obsoleta BOSC, Hist. Nat. des Vers, 1803, p. 93.
Sertularia obsoleta LAMOUROUX, Hist. Polyp. Coralligènes, 1816, p. 197.
Polyserias glacialis MERESCHKOWSKY, Ann. and Mag., 4th ser., XX, 1877, p. 228.
Polyserias hincksii MERESCHKOWSKY, Ann. and Mag., 5th ser., I, 1878, p. 337.
Selaginopsis hincksii MERESCHKOWSKY, Ann. and Mag., 5th ser., II, 1878, p. 444.
Selaginopsis obsoleta KIRCHENPAUER, Nordische Gattungen, 1884, p. 10.

Trophosome.—Colony attaining a height of about 4 inches. Stem thick, slightly geniculate, divided into irregular internodes, the tendency being toward an arrangement in which there are two branches to an internode, with an occasional very deeply cut node, particularly on the distal portion, and also very shallow annulations that are much more numerous than the real nodes. Branches alternate, closely approximated, springing from short processes from the stem from which they are separated by very deep nodes; otherwise the nodes are almost entirely absent. Hydrothecæ arranged in six regular series so that they form both vertical rows and spirals, tubular, rather short, broader at the base, and narrowing distally to the smooth margin and oval aperture; there are no marginal teeth, and the operculum is composed of a single abcauline flap.

There is usually a distinct space intervening between the top of one hydrotheca and the bottom of the one immediately above it.

"Gonophores in a young state in the form of a reversed cone, just as in *P. mirabilis*, but generally smaller. In the adult state they retain their conical form, but the cone becomes larger and more elongated; below, it is attached by a short peduncle; above, it is truncate, with the margins much rounded, and furnished with a tube of very inconsiderable length, which is scarcely observable, and much narrower than in the preceding species. The gonothecæ of this species are never present in such abundance as in *P. mirabilis.*"

Distribution.—Polar Sea (Lepechin); White Sea (Mereschkowsky); St. Pauls Island, Bering Sea, 23 to 25 fathoms (A. and A. Krause); *Albatross* Station 3508, lat. N. 58° 33′, long. W. 164° 49′, 23 fathoms.

Kirchenpauer, who had access to the type specimens of *S. obsoleta* in the Leipsic Museum, declares that the *S. hincksii* of Mereschkowsky is a synonym of this species.

Not having the material upon which to base a decision, the present writer adopts the position taken by Kirchenpauer, as that writer had the advantage of studying Lepechin's type. The above description of the gonosome is quoted entire from Mereschkowsky.[1]

Type.—In Leipsic Museum.

[1] Annals and Magazine of Natural History, 5th ser., I, 1878, p. 337.

SELAGINOPSIS ALTERNITHECA (Levinsen)

(Plate XL, figs. 5–7.)

Thuiaria alternitheca LEVINSEN, Vid. Meddel. naturh. Foren., 1892, p. 32.

Trophosome.—Colony attaining a height of about 5 inches. Stem spirally twisted, very thick and coarse, divided into long and irregular internodes. Branches springing from all sides of the stem, dividing dichotomously sometimes three or four times, making a flabellate structure resembling somewhat the branches of *Thuiaria thuja.* Nodes usually absent, except that there is a sharp constriction at the base of each branch and branchlet. Hydrothecæ very stout, much broader below than above, arranged in two rows on the sides of the flattened branch, each row thus occupying an edge of the branch, the hydrothecæ of a given row having their distal ends bent alternately to the right and left as in *Hydrallmania;* margin without teeth, aperture round, operculum a single abcauline flap. The top of one hydrotheca rises a little above the base of the one next above.

Gonosome.—Gonangia borne on basal portions of branches, elongate oval, abruptly truncated at distal end, with a very broad aperture and no neck.

Distribution.—Davis Straits, 100 fathoms (Levinsen).

The above description of the main stem and manner of branching is taken from Levinsen's account and figures, the remainder being from a specimen (fragmentary) from the type locality kindly sent me by Professor Levinsen. The species is a very well marked one and looks like a double *Hydrallmania.*

Type slides.—Cat. No. 19809, U.S.N.M.; Cat. No. 18733, Museum of the State University of Iowa; also in the collection of the author.

SELAGINOPSIS HARTLAUBI, new species.

(Plate XL, fig. 8.)

Trophosome.—Colony in type specimen, which is incomplete, about 4½ inches high. Stem divided into very long and irregular internodes. Two rows of completely immersed hydrothecæ, which do not have their distal portions inclined alternately to the right and left, are on opposite sides of the stem. Branches irregularly alternate, not ordinarily dividing into branchlets, internodes long, divided from the very short processes of the stem by a deep constriction. Hydrothecæ in four rows, each of which resembles in arrangement those found in *Hydrallmania,* where the distal ends of the hydrothecæ are bent alternately to the right and left. Individual hydrothecæ stout, tubular, completely immersed, with the distal ends much constricted; margin oval, without teeth or angles. The bases of the hydrothecæ in a given row are not in alignment, as in *Hydrallmania,* and in some places the alignment is so disturbed that the effect of eight, instead of four, rows is produced. In places but two rows are visible in looking at a branch from above, and the hydrothecæ look is if implanted in pairs, the two of a pair having their distal ends inclined the same way, as in fig. 8.

Gonosome.—Not known.

Distribution.—*Albatross* Station 3560, lat. N. 56° 40′, long. W. 169° 20′, depth 43 fathoms.

This remarkable hydroid bears a curious resemblance to what might be called a "four-ply" *Hydrallmania.* The type specimen is much damaged and overgrown with bryozoa, and unfortunately lacks the gonosome.

Type slides.—Cat. No. 19812, U.S.N.M.; Cat. No. 18736, Museum of the State University of Iowa; also in the collection of the author.

SYNTHECIUM Allman (modified).

Trophosome.—Branches opposite, nodes regular. Hydrothecæ opposite or alternate, margins smooth, round, often rimmed or reduplicated. Operculum apparently wanting.

Gonosome.—Gonangia springing from the interior of hydrothecæ, where they replace hydranths.

Allman's original description of this genus was as follows:

"*Trophosome.*—Hydrocaulus divided into internodes, each internode carrying a pair of opposite sessile hydrothecæ.

"*Gonosome.*—Gonangia supported on peduncles which spring from the cavity of certain hydrothecæ, where they take the place of the hydranth."[1]

In his *Challenger* Report, the same writer found reason to modify this definition, at least so far as the trophosome is concerned, as follows:

"Hydrocaulus divided into definite internodes, each internode carrying a pair of opposite hydrothecæ, or a single hydrotheca which alternates with those of the internodes on each side of it. Hydrothecæ adnate for a greater or less extent to the internode."[2]

This genus was recognized by Bale in 1888[3] and by Marktanner-Turneretscher in 1890,[4] who instituted the family Synthecidæ for the accommodation of the genus. Torrey takes just the opposite view, and considers the genus untenable,[5] "since it wrenches from their nearest allies such diverse species as *Sertularella alternans* and *Sertularia campylocarpum*, and unites them on the basis of a feature which is chiefly interesting to the physiologist." When such a character, however, is associated with others, such as the absence of an operculum, the smooth margin, the strictly opposite branches, all in a very definite group of species, we have a perfectly well-defined generic group. The main point of difficulty with the present writer is to determine whether or not this group is of family rather than generic value, as held by Marktanner-Turneretscher. The basing of genera on single characters is a proceeding that is very likely to lead to error, while the grouping of several characters for generic differentiation is a much safer and logical method. As to the gonosome being chiefly interesting to the physiologist, it must be said that in so far as this character is a morphological feature of great usefulness in classification, the systematist would be most unwise to relinquish it.

KEY TO AMERICAN SPECIES OF THE GENUS SYNTHECIUM.

Hydrothecæ opposite.
- Hydrothecæ tubular, curved in the quadrant of a circle, orifice round.
  - Each internode of stem bearing a pair of hydrothecæ .... *tubithecum.*
  - Internodes of stem without hydrothecæ .... *rectum.*
- Hydrothecæ doubly curved, orifice triangular .... *marginatum.*
- Hydrothecæ short and stout, deeply immersed .... *robustum.*

Hydrothecæ alternate .... *cylindricum.*

POINTS OF INTERGRADATION BETWEEN SYNTHECIUM AND OTHER GENERA.

With *Sertularia*, in the strictly opposite hydrothecæ and regular internodes. The resemblance to such species as *S. desmoides* Torrey is quite close. The gonosome, however, is entirely different.

With *Sertularella*, in alternate hydrothecæ, as in *S. cylindricum*. In this case the entire absence of an operculum will serve to identify the genus to which a given species belongs. When the gonosome is present there is no trouble of course.

SYNTHECIUM TUBITHECUM (Allman).

(Plate XLI, fig. 1.)

Sertularia tubitheca ALLMAN, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 24.
Sertularia tubitheca FEWKES, Bull. Mus. Comp. Zool., VIII, No. 7, 1881, p. 128.
Sertularia tubitheca NUTTING, Narrative Bahama Exped., 1895, p. 88.

Trophosome.—Colony consisting of a monosiphonic stem with strictly opposite branches, attaining a height of 1½ inches. Stem cylindrical, divided into regular, long internodes, each of

[1] Journal of the Linnæan Society, XII, 1874, p. 265.
[2] Challenger Report, The Hydroida, Pt. 2, 1888, p. 77.
[3] Proceedings of the Linnæan Society of New South Wales, 2d series, III, 1888, p. 766.
[4] Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 248.
[5] The Hydroida of the Pacific Coast of North America, 1902, p. 62.

which bears a pair of branches on its distal end, below which are one or two pairs of hydrothecæ. Branches opposite, with a constriction at their origin, divided into regular internodes, each of which bears a pair of hydrothecæ near its distal end. Hydrothecæ opposite, long, tubular, regularly curved so as to form nearly a quadrant of a circle; margin round, flaring, often several times reduplicated, in some cases with quite constantly a single reduplication, as described by Allman. Operculum not evident.

Gonosome.—Gonangia springing from the lumen of hydrotheca, oblong-oval, annulated throughout. When examining the type specimens in the Museum of Comparative Zoology the writer found one specimen in which the gonangium was growing from the hydrotheca, and was of characteristic *Synthecium* type.

Distribution.—Tortugas, 18 fathoms (Allman); *Albatross* Station 2311, lat. N. 32° 55′, long. W. 77° 54′, 79 fathoms; Station 2331, lat N. 23° 10′ 31″, long. W. 82° 19′ 55″, 114 fathoms; Station 2410, lat. N. 26° 47′ 30″, long. W. 83° 25′ 15″, 28 fathoms; Station 2413, lat. N. 26°, long. W. 82° 57′ 30″, 24 fathoms; Station 2414, lat. N. 25° 04′ 30″, long. W. 82° 59′ 15″, 26 fathoms. Off Barbados, 76 fathoms (Fewkes).

The presence of pairs of hydrothecæ on the stem seems to be the best character by which this species can be separated from *S. rectum.*

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

SYNTHECIUM RECTUM, new species.

(Plate XLI, fig. 2.)

Trophosome.—Colony consisting of a monosiphonic stem, with strictly opposite branches attaining a height of about three-fourths of an inch. Stem straight, tubular, exceedingly transparent, with distant and irregular nodes, or none. Branches opposite, originating from a tubular process of the stem, from which a branch springs like a section of a telescope. This feature, however, is not constant. Branches divided into regular internodes, each of which bears a pair of hydrothecæ on its distal half and does not become noticeably attenuate near its proximal end, branches in many cases forming a right angle with the stem from which they spring. Hydrothecæ tubular, cylindrical, regularly curved through a quadrant of a circle, the aperture opening directly outward, not contingent in front, free for more than their distal half; margin entire, sometimes slightly everted, and usually with a distinct narrow rim; no operculum. There are no hydrothecæ on the branch-bearing portion of the stem.

Gonosome.—Not known.

Distribution.—Dredged near Habana, Cuba, by the Bahama Expedition from the State University of Iowa; *Albatross* Station 2416, lat. N. 31° 26′, long. W. 77° 07′, 276 fathoms.

This species has been compared with Allman's type of *Sertularia tubitheca* in the Museum of Comparative Zoology and found to be quite distinct, being much more transparent in structure and not having pairs of hydrothecæ regularly distributed on the stem.

Type slides.—Cat. No. 19715, U.S.N.M. Cat. No. 18671, Museum of the State University of Iowa; also in the collection of the author.

?SYNTHECIUM MARGINATUM (Allman).

(Plate XLI, fig. 3.)

Sertularia marginata Allman, Mem. Mus. Comp. Zool., V, No. 2, 1877, p. 23.

"*Trophosome.*—Hydrocaulus attaining a height of about an inch, simple; internodes elongated, attenuated below every pair of hydrothecæ. Hydrothecæ opposite, deep, tubular, free and divergent above for about three-fifths of their height, slightly tumid below, orifice entire, with a broad rim formed by close striæ, which run in a circular direction round the distal end of the hydrothecæ."

Gonosome.—Not known.

Distribution.—Off Florida Reef, 324 fathoms (Allman).

I have not seen this species and have copied the description of Allman entire. The species evidently belong to the *Synthecium* group, and appears to be an exceptionally well-marked form.

Type.—In the Museum of Comparative Zoology, Cambridge, Massachusetts.

SYNTHECIUM ROBUSTUM, new species.

(Plate XLI, figs. 4–6.)

Trophosome.—Colony attaining a height of 2½ inches. Stem not fascicled, straight, without hydrothecæ below the proximal branches, hydrothecate above, divided into irregular internodes. Branches strictly opposite and divided into branchlets; main branch straight, giving off pairs of strictly opposite branchlets and bearing as a rule three pairs of hydrothecæ between adjacent branchlets; internodes variable; the most common arrangement being one for each pair of branchlets, there being two pairs of hydrothecæ above and one below the branchlets; branchlets straight, with a tendency toward an internode to each pair of hydrothecæ. Hydrothecæ tubular, short, stout, extensively immersed, only a small part of the distal adcauline side being free; margin neither constricted nor flaring, and without ornamentation, but sometimes broadly sinuated; aperture round, sometimes subtriangular. No operculum.

Gonosome.—Gonangia springing from the interior of hydrothecæ, terete, heavily annulated, with a very small tubular neck and round aperture. The specimens were dried, and the gonangia greatly distorted, making it necessary to attempt a somewhat uncertain reconstruction in the drawings.

Distribution.—*Albatross* Station 2776, lat. S. 52° 41′, long. W. 69° 55′ 30″, 21 fathoms.

This species has shorter and more extensively immersed hydrothecæ than any of the others of the genus thus far described.

Type slides.—Cat. No. 19714, U.S.N.M.; Cat. No. 18670, Museum of the State University of Iowa; also in the collection of the author.

SYNTHECIUM CYLINDRICUM (Bale).

(Plate XLI, fig. 7.)

Sertularella cylindrica Bale, Proc. Linn. Soc. New South Wales, 2d. ser., III, 1888, p. 765.
Sertularella cylindrica Hartlaub, Revision der Sertularella-Arten, 1900, p. 65.
Sertularella halecina Torrey, Hydroida of the Pacific Coast, 1902, p. 61.

"Hydrocaulus about half an inch in height, simple or slightly branched, divided by oblique joints into internodes of moderate length, each bearing a hydrotheca on its upper part. Hydrothecæ adnate nearly half their height, large, stout, cylindrical, smooth, usually somewhat rounded at the base, curved outward; aperture looking outwards and upwards, not contracted, margin entire, very slightly everted, peristome often double or triple.

"*Gonosome.*—Gonothecæ (male) arise from within hydrothecæ; long, tubular, somewhat broader than hydrothecæ, and five or six times as long as broad. A single tubular gonophore."

Distribution.—Port Jackson, Australia (Bale); San Diego Bay, California, 5 to 12 fathoms (Torrey).

The description and figures of *Sertularella halecina* Torrey almost exactly agree with those of *S. cylindrica* Bale, leaving no room for doubt of the identity of the two species. Hartlaub[1] suggests the probable identity of *S. cylindrica* and *Sertularia integra* Allman.[2] The original figures of these two species are so different that one is at a loss to imagine why this suggestion was made.[2]

I have not seen this species, and have copied the above description of the trophosome from Bale, and that of the gonosome from Torrey.

Type.—In the Australian Museum ?.

[1] Revision der Sertularella-Arten, 1900, p. 65. [2] Journal of the Linnæan Society, XII, 1874, pl. XIII, fig. 4.

ANNOTATED BIBLIOGRAPHY.

The author has included in the bibliography for this section:

First. The works containing original descriptions of the genera of Sertularidæ, and also those containing original descriptions of species of this family that have been found in American waters.

Second. All works containing important discussions of the embryology and morphology of the characteristic features of the Sertularidæ.

Third. All works containing an important systematic discussion of this group.

Fourth. All works which contain original and important data concerning the geographical distribution of the Sertularidæ. This does not include mere faunal lists, unless they pertain to a geographical region not covered by the other works included in this bibliography, or give a new geographical range for American species of Sertularidæ.

AGASSIZ, ALEXANDER..........North American Acalephæ. (Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College, No. II, Cambridge, 1865.)

Contains a mention of all North American Sertularidæ known at that time, as well as a bibliography of each species.

AGASSIZ, LOUIS ....Contributions to the Natural History of the United States of America. Second Monograph, IV, Boston, 1862.

Contains a beautifully illustrated study of *S. pumila* and a complete bibliography of the Hydroida.

ALDER, JOSHUA.................A Catalogue of the Zoophytes of Northumberland and Durham. (Transactions of the Tyne-Side Naturalists' Field Club, Newcastle-on-Tyne, III, 1857, p. 1.)

Contains the original descriptions of *Sertularella tricuspidata* and *Sertularella tenella*.

The same species, together with the same plates, were described and figured the preceding year in the Annals and Magazine of Natural History, 2d series, XVIII, pp. 356–357, in a paper entitled A Notice of some new genera and species of British Hydroid Zoophytes, by Joshua Alder, esq.

ALLMAN, GEORGE J...........A Monograph of the Gymnoblastic or Tubularian Hydroids. In two parts. Part I, The Hydroida in General. (Ray Society, London, 1871, pp. 1–231.)

Contains a good account of the development of *Diphasia rosacea* and *Sertularia pumila*.

ALLMAN, GEORGE J...........Diagnosis of New Genera and Species of Hydroids. (Read December 17, 1874.) (Journal of the Linnæan Society, Zoology, XII, p. 251.)

Original descriptions of the genera *Synthecium* and *Selaginopsis* and of *Sertularella episcopus*.

ALLMAN, GEORGE J...........Descriptions of some New Species of Hydroida from Kerguelen Island. (Annals and Magazine of Natural History, 4th series, XVII, 1876, p. 113).

Contains the original description of *Sertularella unilateralis*.

ALLMAN, GEORGE J...........Report on the Hydroida collected during the Exploration of the Gulf Stream by L. F. de Pourtales, assistant, United States Coast Survey. (Memoirs of the Museum of Comparative Zoology at Harvard College, V, No. 2, Cambridge, 1877.)

Contains original descriptions of *Sertularella conica*, *S. amphorifera*, *Synthecium marginatum*, *S. tubitheca*, *Sertularia tumida*, *S. exigua*, *S. rathbuni* (under name of *Thuiaria sertularioides*), *S. pourtalesi* (under name of *Sertularia distans*), *Thuiaria plumulifera*, and *Sertularella distans*.

ALLMAN, GEORGE J...........Description of Australian, Cape, and other Hydroids, mostly new, from the Collection of Miss H. Gatty. Read March 19, 1885. (Journal of the Linnæan Society: Zoology, XIX, p. 132.)

Original description of the genus *Thecocladium*, and of *Sertularella margaritacea*, *S. diffusa*, and *Thuiaria ramosissima*.

ALLMAN, GEORGE J.........The voyage of H. M. S. *Challenger*. Zoology. Report on the Hydroida dredged by H. M. S. *Challenger* during the years 1873–1876. Part II. The Tubularinæ, Corymorphinæ, Campanularinæ, Sertularinæ, and Thalamophora. 1888.

Original descriptions of the genera *Staurotheca* and *Dictyocladium*, and of *Sertularella filiformis*, *S. clausa*, *S. catena*, *S. cylindritheca*, *S. quadrifida* (under name of *Thuiaria quadridens*), *Sertularia challengeri* (under name of *Desmoscyphus pectinatus*), *Sertularia versluysi* (under name of *Desmoscyphus gracilis*).[1]

BALE, W. M ....On the Hydroida of Southeastern Australia, with descriptions of supposed new species, and notes on the genus Aglaophenia. Melbourne, 1881. (Journal of the Microscopical Society of Victoria, II, p. 1)

Valuable as recording occurrence in Australia of a few American forms.

BALE, W. M ....Catalogue of the Australian Hydroid Zoophytes. Sydney, 1884.

Contains good systematic discussions, and descriptions of Sertularidæ.

BALE, W. M ....Some new and rare Hydroida in the Australian Museum Collection. (Proceedings of the Linnæan Society of New South Wales, 2d series, III, June 27, 1888, p. 745.)

Contains original description of *Synthecium cylindricum*.

BEDOT, MAURICE, and PICTET, CAMILLE. Résultats des Campagnes Scientifiques accomplies sur son Yacht par Albert Ier, Prince Souverain de Monaco. Fascicule XVIII. Hydraires provenant des campagnes de l'Hirondelle. 1886–1888. Monaco. 1900.

Unrivaled as a perfect sample of illustration and of bookmaking, so far as the literature of the Hydroids is concerned.

BERGH, R. S ....Goplepolyper (Hydroider) fra Kara Havet. 1887, p. 331. (The serial in which this was published is not indicated in the copy in possession of the author.)

Extends the known distribution of several sertularians to the Arctic Sea.

BONNEVIE. KRISTINE.........The Norwegian North Atlantic Expedition, 1876–1878. Zoology. Hydroida. Christiania, 1899.

A valuable work, especially in adding to our knowledge of both the geographical and bathymetric distribution of several sertularians.

CALKINS, GARY N...........Some Hydroids from Puget Sound. (Proceedings of the Boston Society of Natural History, XXVIII, No. 13, January, 1899, p. 333.)

Extends known range of several species of *Sertularidæ*.

CLARK, S. F ....Report on the Hydroids collected on the coast of Alaska and the Aleutian Islands by W. H. Dall, U. S. Coast Survey, and Party, from 1871 to 1874 inclusive. (Proceedings of the Academy of Natural Sciences of Philadelphia, 1876, p. 209.)

An important paper containing original descriptions of *Thuiaria dalli* (under name of *Sertularia cupressoides*), *Abietinaria variabilis*, *A. inconstans*, *Thuiaria thuiarioides*, *T. robusta*, *T. plumosa*, *Abietinaria turgida*, *A. gigantea*, *Sertularella pinnata*. It also extends the known geographical distribution of a number of well-known species of Sertularidæ.

CLARK, S. F ....The Hydroids of the Pacific Coast of the United States, south of Vancouver Island. With a Report upon those in the Museum of Yale College. (Transactions of the Connecticut Academy, III, 1876, p. 249.)

Gives a list of seven species of sertularians, some of which had not been before reported from the Pacific coast.

CLARKE, S. F ....Report on the Hydroida collected during the Exploration of the Gulf Stream and Gulf of Mexico by Alexander Agassiz, 1877–78. (Bulletin of the Museum of Comparative Zoology, V, No. 10, 1879, p. 239.)

Extends known range of *Sertularia cornicina* (under name of *S. complexa*) and of several other sertularians.

CLARKE, S. F ....Reports on the Dredging Operations off the West Coast of Central America to the Galapagos, to the West Coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission steamer *Albatross* during 1891, Lieut. Commander Z. L. Tanner, U. S. Navy, commanding. XI. The Hydroids. (Bulletin of the Museum of Comparative Zoology, XXV, 1894, p 71.)

Original description of *Sertularella tropica* (under name of *Sertularia variabilis*).

COUGHTREY, MILLEN.........Critical Notes on the New Zealand Hydroida, Suborder Thecophora. (Annals and Magazine of Natural History, 4th series, XVII, 1876, p. 22.)

Finds *Sertularia pumila* in New Zealand.

DRIESCH, HANS..............Tektonische Studien an Hydroidpolyper, Jena, 1890, p. 189.

Discusses the mode of branching and the order of succession of the persons of the hydroid colony.

[1] When both the generic and specific names have been changed, the original name is given. Where the generic name only has been changed, the original name is not given.

D'URBAN, W. S. M..........The Zoology of Barents Sea. (Annals and Magazine of Natural History, 5th series, VI, 1880, p. 253.)

Adds several species of hydroids to those known to occur in the Arctic Ocean.

ELLIS, JOHN ....An Essay toward a Natural History of the Corallines, and other Marine Productions of the like Kind, Commonly found On the Coasts of Great Britain and Ireland. London, 1755.

A monumental work, giving original descriptions of a number of species, but under English names, the binomial system not having at that time been adopted.

ELLIS, JOHN, and SOLANDER, DANIEL..The Natural History of many curious and uncommon Zoophytes, collected from various parts of the globe by the late John Ellis, esq., F. R. S. London, 1786.

In this work the species described in the preceding, and others, receive their binomial designations. Linnæus had, in the meantime, however, applied these binomials, and so receives the credit of being the original describer according to our present system. The work contains strictly original descriptions of *Thuiaria lonchitis*, *Abietinaria filicula*, and *Pasythea quadridentata*.

FABRICIUS, OTHO ....Fauna Groenlandica Systematica sistens Animaliæ, MDCCLXXX.

Contains the earliest report regarding the occurrence of some of the sertularians in Greenland.

FEWKES, J. WALTER..........Reports on the Results of Dredging under the Supervision of Alexander Agassiz in the Caribbean Sea, in 1878, 1879, and along the Atlantic Coast of the United States, during the Summer of 1880, by the U. S. Coast Survey Steamer "*Blake*," Commander J. R. Bartlett, U. S. N., commanding.

Report on the Acalephæ. (Bulletin of the Museum of Comparative Zoology, VIII, No. 7, 1881, p. 127.) Contains the original description of *Sertularella formosa*.

FEWKES, J. WALTER..........An aid to the Collector of the Cœlenterata and Echinodermata of New England. (Bulletin of the Essex Institute, XXIII, Nos. 1, 2, 3, 1891, p. 1.)

Designed for popular use.

FORBES, E ....On the Morphology of the Reproductive System of the Sertularian Zoophytes, etc. (Annals and Magazine of Natural History, XIV, 1844, p. 385.)

Interesting as a scientific curiosity. The writer discusses the analogies between the reproductive systems of plants and hydroids.

GOULD, AUGUSTUS A ....A report on the Invertebrata of Massachusetts, comprising the Mollusca, Crustacea, Annelida, and Radiata. Cambridge, 1841. Reports *Sertularia pinnata* Pallas.

GRAY, JOHN EDWARD.........List of the Specimens of British Animals of the Collections of the British Museum. Part I, Radiated Animals. London, 1847.

Contains the original description of the genus *Sertularella*.

HAMANN, OTTO................Der Organismus der Hydroidpolypen. (Separat-Abdruck aus der Jenaischen Zeitschrift für Naturwissenschaft, XV, New Series VIII, Jena, 1882, pp. 1–72.)

A general morphological discussion of the Hydroida.

HARGITT, CHARLES W ....Synopses of North American Invertebrates. XIV. The Hydromedusæ. Part II, p. 379. (American Naturalist, XXXV, 1901.)

A compilation. Useful in determining the common species of the New England coast, but far from complete.

HARTLAUB, CLEMENS..........Die Hydromedusen Helgolands. 2. Bericht. (Beiträge zur Meeres-Fauna von Helgolands. X. Wissenschaftiche Meeresuntersuchungen herausgegeben von der Kommission zur Untersuchung der deutschen Meere in Kiel und der biologischen Anstalt auf Helgoland, n. f., II, Heft. 1, Abth. 2.) 1897.

A valuable work, but containing little of interest concerning the Sertularidæ, except a small faunal list.

HARTLAUB, CLEMENS..........Revision der Sertularella-Arten. (Sonder-Abdruck aus Band XVI. der Abhandlungen aus dem Gebiete der Naturwissenschaften. Herausgegeben von Naturwissenschaftlichen Verein, Hamburg, 1901. Reprinted from a separate dated 1900.)

A work of the highest rank. No original descriptions, but new names are given in three cases, *Sertularella quadrifida* (for *Thuiaria quadridens* Allman), *Sertularella allmani* (for *Sertularia unilateralis* Allman), and *S. tropica* (for *S. variabilis* Clarke). The work contains an excellent systematic discussion, extensive tables of synonymy, and complete record of the known geographical and bathymetric distribution of the genus.

HARTLAUB, CLEMENS..........Hydroiden aus dem Stillen Ocean. Ergebnisse einer Reise nach dem Pacific (Schauinsland, 1896–98). (Zoologische Jahrbücher: Abtheilung für Systematik, Geographie, und Biologie der Thiere. Jena, May 31, 1901, p. 349.)

Largely a compilation. Contains the original description of *Sertularella nana*.

HELLER, CAM .... Die Zoophyten und Echinodermen der adriatischen Meeres. (Herausgegeben von der k. k. zoologisch-botanischen Gesellschaft. Wien, 1868.)

Interesting, on account of geographical distribution of some well-known sertularians.

HINCKS, THOMAS H .... A Catalogue of the Zoophytes of South Devon and South Cornwall. (Annals and Magazine of Natural History, 3d series, VIII, 1861, p. 251.)

Contains the original description of *Sertularella fusiformis*.

HINCKS, THOMAS H .... A History of the British Hydroid Zoophytes, London, 1868.

A very important work. Original description of the genus *Hydrallmania*.

HINCKS, THOMAS .... On Deep-water Hydroida from Iceland. (Annals and Magazine of Natural History, 4th series, XIII, 1874, p. 146.)

Contains the original description of *Sertularella geniculata*.

JOHNSTON, GEORGE .... A History of the British Zoophytes, 2d ed., London, 1847.

One of the British classics.

KIRCHENPAUER, G. H .... Neue Sertulariden aus verschiedenen Hamburgischen Sammlungen, nebst allgemeinen Bemerkungen über Lamouroux's Gattung Dynamena. Dresden, 1864.

A systematic discussion of *Sertularia* and *Dynamena*. Excellent figures.

KIRCHENPAUER, G. H .... Nordische Gattungen und Arten von Sertulariden; (Abhandlungen aus dem Gebiete der Naturwissenschaften herausgegeben von Naturwissenschaftlichen Verein in Hamburg. VIII, Pt. 3, 1884.)

Contains descriptions of many sertularians. Proposes the genus *Abietinaria*. Original description of *Thuiaria elegans*, *T. annulata*, *Sertularella contorta*, *S. albida*, *S. subdichotoma*, *S. sieboldi*.

LAMARCK, J. B. P. A. de ..... Histoire naturelle des animaux sans vertèbres. 2nd edition, 1836.

A classic work. Restricts the genus *Sertularia* by setting off the genera *Antennularia* and *Plumularia*.

LAMOUROUX, J. V. F .... Extrait d'un mémoire sur la classification des Polypes coralligènes non entièrement pierreux (Nouveau Bulletin des Sciences par la Société philomatique de Paris, III). Paris, 1812.

An important paper. Defines *Dynamena*, *Sertularia*, and *Pasythea*, and sets aside the Campanularians and Plumularians from the Sertularidæ.

LAMOUROUX, J. V. F .... Histoire des Polypiers coralligènes flexibles vulgairement nommés Zoophytes. Caen, 1816.

Contains descriptions of all sertularians known at that time. No new species. A good bibliography.

LAMOUROUX, J. V. F .... Exposition méthodique des Genres de l'ordre des Polypiers, avec leur description et celle des principales espèces, figurées dans 84 planches, etc. Paris, 1821.

Original description of *Sertularella gayi*.

LENDENFELD, R. VON .... The Australian Hydromedusæ. (Proceedings of the Linnæan Society, New South Wales IX, X. 1884–5, pp. 206–241, 401–420). Contains an elaborate systematic discussion of the Hydroida, and reports some species of sertularians that are also found in American waters.

LEVINSEN, G. M. R. .... Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst telligemed Bemærkninger om Hydroidernes Systematik. (Saertryk af Videnskabelige Meddelelser fra der naturhistoriske Forening, 1892. Kjøbenhavn, 1892, p. 1.)

A very valuable paper, especially in its masterly systematic discussions and investigations concerning the operculum. Contains original description of *Thuiaria fabricii* and *Selaginopsis alternitheca*.

LEVINSEN, G. M. R .... Om Fornyelsen af Ernæringsindividerne hos Hydroiderne. (Same publication as above, 1892, p. 12.)

Another paper containing a discussion of the operculum, and also of the reduplication of the hydrothecal margin.

LINNÆUS, C .... Systema Naturæ per Regna Tria Naturæ secundum Classes, Ordines, Genera, Species, cum characteribus Differentiis, Synonymis, Locis. 10th edition, 1758.

Our present nomenclature being based on the system of Linnæus, this work is an indispensable classic. It contains the original binomial descriptions of the following species: *Sertularia pumila*, *S. operculata*, *Diphasia rosacea*, *D. tamarisca*, *Thuiaria cupressina*, *T. argentea*, *T. thuja*, *Hydrallmania falcata*, *Abietinaria abietina*, *Sertularella rugosa*, *S. polyzonias*, and *Selaginopsis cedrina*.

McCREADY, JOHN .... Gymnophthalmata of Charleston Harbor. (Proceedings of the Elliott Society, I, No. 1, 1858, p. 103.)

An American classic. Original description of *Sertularia cornicina*.

MARKTANNER-TURNERETSCHER, GOTTLIEB. Die Hydroiden des k. k. naturhistorischen Hofmuseums. (Annalen des k. k. naturhistorischen Hofmuseums, V, Pt. 2, 1890, p. 195.)
An important work, especially in its systematic discussions. Proposes the genera *Calyptothuiaria* and *Monopoma* that are not adopted in this work. Contains a good bibliography, and original descriptions of *Sertularia tubuliformis* and *Sertularella magellanica*.

MERESCHKOWSKY, C ....New Hydroida from Ochotsk, Kamtschatka, and other parts of the North Pacific Ocean. (Annals and Magazine of Natural History, 5th series, II, 1878, p. 433.)
A comprehensive treatment of *Selaginopsis*. Original descriptions of *S. triserialis*, *S. pinnata*, *Abietinaria compressa*, and *Sertularella clarkii*.

MEYEN, F. J. F..............Beiträge zur Zoologie, gesammelt auf einer Reise um die Erde. Kaiserliche Leopoldino-Carolinische deutsche Akademie der Naturforscher, XVII, 1835, pp. 1–125.
Contains the original description of *Sertularella picta*.

MURRAY, ANDREW...........Descriptions of new Sertularidæ from the Californian Coast. (Annals and Magazine of Natural History, 3d series, V, 1860, p. 250.)
Original description of *Sertularella greenei* (under name of *Sertularia tricuspida*) and *Diphasia corniculata*.

NORMAN, A. M..............Note on Selaginopsis (=*Polyserias hincksii*, Mereschkowsky) and on the circumpolar distribution of certain Hydrozoa. (Annals and Magazine of Natural History, 5th series, I, 1878, p. 189.)
Contents denoted by title.

NUTTING, C. C ....Bahama Expedition. (Bulletins from the Laboratories of Natural History of the State University of Iowa, III, Nos. 1 and 2, 1895.)
Original description of *Sertularella quadrata*.

NUTTING, C. C ....Hydroida from Alaska and Puget Sound. (Proceedings of the U. S. National Museum, XXI, No. 1171, 1899, p. 741).
Original description of *Hydrallmania distans*. Discusses geographical distribution.

NUTTING, C. C ....The Hydroids of the Woods Hole Region. (Bulletin of the U. S. Fish Commission for 1899. 1901, p. 325.)
Serves for identification of sertularians of the region.

NUTTING, C. C ....Papers from the Harriman Alaska Expedition, XXI, The Hydroids. (Proceedings of the Washington Academy of Sciences, III, pp. 157–216, May, 1901.)
Discusses faunal regions of North Pacific Coast, and circumpolar distribution. Original descriptions of *Abietinaria coei*, *Diphasia kincaidi* (under name of *Thuiaria elegans*), and *Abietinaria costata*.

D'ORBIGNY, ALCIDE.........Voyage dans l'Amérique Méridionale, exécuté pendant les années 1826, 1827, 1828, 1829, 1830, 1831, 1832, et 1833, V, Pt. 4: Zoophytes, Paris, 1839 et 1846.
Original descriptions of *Sertularia pulchella*, *Sertularella patagonica*, and *S. milneana*. Excellent figures.

PACKARD, A. S., Jr ....A List of Animals dredged near Caribou Island, Southern Labrador, during July and August, 1860. (Canadian Naturalist and Geologist, December, 1863.)
Indicates new range for some well-known species.

SÆMUNDSSON, B.. ....Bidrag til Kundskaben om de Islandske Hydroider, 1902.
Valuable on account of data regarding geographical distribution.

SARS, G. O...................Bidrag til Kundskaben om Norges Hydroider. (Særskilt aftrykt af Videnskabelige-Selskabets Forhandlinger for 1873, p. 1.)
Contains valuable data on distribution, and the original description of *Thuiaria tenera*.

SCHNEIDER, KARL CAMILLO...Hydropolypen von Rovigno, nebst Uebersicht über das System der Hydropolypen im Allgemeinen. (Zoologische Jahrbücher, Abtheilung für Systematik, X, 1897, p. 472.)
Contains a good systematic discussion of the relationship of the families of Hydroida, and the genera of the Sertularidæ.

SCHULZE, FRANZ EILHARD ...Nordsee Expedition, 1872, III, Cœlenteraten, 1874, p. 121.
Contains extensive tables showing geographical and bathymetric distribution.

STIMPSON, WILLIAM..........Synopsis of the Marine Invertebrata of Grand Manan, or the region about the Mouth of the Bay of Fundy, New Brunswick. (Smithsonian Contributions to Knowledge, VI, Article V, 1854.)
Contains original descriptions (without figures) of *Thuiaria latiuscula*, and "*Sertularia producta*" which seems to be a synonym of *Diphasia tamarisca*.

THALLWITZ, JOHANNES ....Ueber die Entwicklung der Mannlichen Keimzellen bei den Hydroiden. (Jenaische Zeitschrift, XVIII, 1885, p. 385.)
Discusses the origin of the spermatozoa in *Sertularella polyzonias*.

THOMPSON, D'ARCY W........On some new and rare Hydroid Zoophytes (Sertulariidæ and Thuiariidæ) from Australia and New Zealand. (Annals and Magazine of Natural History, 5th series, II, 1879, p. 97.)

Describes the only known *Selaginopsis* from the Southern Hemisphere.

THORNELY, LAURA ROSCOE....The Hydroid Zoophytes collected by Doctor Willey in the Southern Seas. (Reprinted from A. Willey's Zoological Results, Part IV, p. 456. Cambridge University Press, 1899.)

Gives new record for *Sertularia pumila* and *Pasythea quadridentata*.

TORREY, HARRY BEAL.........The Hydroida of the Pacific Coast of North America. (University of California Publications, Zoology I, pp. 1–104. November, 1902.)

An important work, containing discussion of geographical distribution on the Pacific coast, and original descriptions of *Sertularella dentifera*, *Sertularia desmoides*, and *Abietinaria traski*.

VARENNE, ANDRE DE..........Recherches sur la Reproduction des Polypes Hydraires. (Archives de Zoologie expérimentale et générale, X, Paris, 1882, pp. 1–100.)

Includes an account of the embryology of *Sertularia pumila*.

VERRILL, A. E., and SMITH, S. I. Report upon the Invertebrate Animals of Vineyard Sound and Adjacent Waters, with an Account of the Physical Characters of the Region. (Report of the Commissioner of Fish and Fisheries, 1871–72, pp. 295–478.)

A valuable work, giving the habitat and local distribution of many sertularians.

VERRILL, A. E...............Preliminary Check-list of the Marine Invertebrata of the Atlantic Coast, from Cape Cod to the Gulf of St. Lawrence. (Prepared for the U. S. Commission of Fish and Fisheries, 1879. Author's edition, New Haven, June, 1879, pp. 1–32.)

Contains a list of 20 species of sertularians, many of which are first reported in America in numerous short papers by the same author.

VERSLUYS, J. JUNE ....Hydraires Calyptoblastes recueillis dans la Mer des Antilles pendant l'une des Choisières accomplis par le Comte R. de Dalmas sur son yacht *Chazalie*. (Mémoires de la Société zoologique de France, XII, Pt. 1, p. 29, Paris, 1899.)

Contains the original description of *Sertularia brevicyathus*.

WEISMANN, AUGUST...........Die entstehung der Sexualzellen bei den Hydromedusen. Zugleich ein Beitrag zur Kentniss des Baus und der Lebenserscheinungen dieser Gruppe. Jena, 1888.

Contains a good account of the origin of the sex cells in *Sertularia pumila* and *Sertularella polyzonias*.

WHITEAVES, J. F.............Catalogue of the Marine Invertebrates of Eastern Canada (Geological Survey of Canada), 1902.

Valuable for material on geographical distribution. Gives new locality for *Sertularella fusiformis*.

WINTHER, GEORG.............Om Internodiets Bygning og sammensætning hos Sertularierne. (Naturhistorisk Tidsskrift, 1879–80, p. 304.)

Discusses variation in internodes and position of hydrothecæ in five well-known species of Sertularidæ.

LIST OF WORKS TO WHICH REFERENCE IS MADE IN THE SYNONYMIES IN THE SYSTEMATIC PART OF THIS WORK, BUT WHICH HAVE NOT BEEN CONSULTED BY THE AUTHOR.

When the title is preceded by an asterisk (*) the references to that work are made on the authority of Hartlaub's Revision der Sertularella-Arten. Otherwise the references are made on the authority of M. Bedot's Matériaux pour servir à l'Histoire des Hydroides.

*BENNET and VAN OLIVIER. Naamlijst van Wormen, in Nederland aanwezig. (Natuurkundige Verhandelingen van de Hollandsche Maatschappÿ der Wetenschappen te Haarlem. D. XV, 2, p. 1–256.) 1826.

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EDWARDS, GEORGES. Gleanings of Natural History. 3 vols. London, 1758-1764.

ESPER, E. J. C. Fortsetzungen der Pflanzenthiere. Pt. 2. Nürnberg, 1794-1806.

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*V. ETZEL. Grönland, geographisch und statistisch beschreiben. Aus dänischen Quellschriften. Stuttgart, 1860.

*FARQUAHR. List of New Zealand Hydroida. (Translations of the New Zealand Institute, XXVIII, p. 459, 1895.)

*GRAEFFE. Übersicht der Seetierefauna des Golfes von Triest. (Arbeiten aus dem Zoolologischen Institute, Wien und Triest, V, p. 333.) 1884.

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*HERKLOTZ. De Weekdieren en lagere Dieren II. (Natuurlyke Historie van Nederland.) Amsterdam, 1870.

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EXPLANATION OF PLATES.

Unless otherwise indicated all of the figures in the plates were drawn by Mrs. Lilian Hulsebus Crone after original camera lucida sketches from nature by Prof. C. C. Nutting. Where figures were copied from the works of other authors the source is indicated, and the copies were made by Mrs. Crone.

The text figures illustrating the stem, hydranths, and gonophores, unless otherwise indicated, were drawn by Mr. J. H. Paarmann after camera lucida sketches by the author. All of the other text figures were drawn by Mr. Paarmann with the aid of the camera lucida, except when copies were made from other publications, in which case the source is indicated in the explanation of the figures.

Plate I.

Fig. 1. *Sertularia pumila* Linnæus. Portion of main stem and branches (enlarged).
2. *Sertularia pumila.* Side view of branch, showing gonangium (enlarged).
3. *Sertularia pumila.* Pair of hydrothecæ and expanded hydranth (greatly enlarged).
4. *Sertularia versluysi* Nutting. Portion of main stem and branches (enlarged).
5. *Sertularia versluysi.* Part of branch (enlarged).
6. *Sertularia versluysi.* Branch from another colony (enlarged).
7, 8, 9. *Sertularia versluysi.* Pairs of hydrothecæ (greatly enlarged).

Plate II.

Fig. 1. *Sertularia challengeri* Nutting. Portion of stem and branches from Allman's type of *Desmoscyphus pectinatus* Allman (enlarged).
2. *Sertularia challengeri.* Part of branch from same specimen (greatly enlarged).
3. *Sertularia operculata* Linnæus. Portion of branch with gonangium (enlarged).
4. *Sertularia operculata.* A pair of hydrothecæ (greatly enlarged).
5. *Sertularia operculata.* Side view of hydrotheca (greatly enlarged).
6. *Sertularia pulchella* (d'Orbigny). Portion of branch with gonangium (enlarged). (After d'Orbigny.)
7. *Sertularia pulchella.* Part of branch with gonangium (enlarged). (After Clarke's drawing of *Sertularia furcata* Trask.)
8. *Sertularia bispinosa* (Gray). Part of branch (enlarged).
9. *Sertularia bispinosa.* Pair of hydrothecæ (greatly enlarged).
10. *Sertularia bispinosa.* Side view of branch (enlarged).
11. *Sertularia bispinosa.* Side view of hydrotheca (greatly enlarged).

Plate III.

Fig. 1. *Sertularia desmoides* Torrey. Part of branch (enlarged).
2. *Sertularia desmoides.* Pair of hydrothecæ (greatly enlarged).
3. *Sertularia desmoides.* End of hydrotheca, showing aperture (greatly enlarged).
4. *Sertularia rathbuni* Nutting. Portion of branch (enlarged).
5. *Sertularia rathbuni.* Pair of hydrothecæ (greatly enlarged).
6, 7. *Sertularia rathbuni.* Lateral views of hydrothecæ, showing tridentate margins (greatly enlarged).
8, 9. *Sertularia rathbuni.* Two other views of margins (greatly enlarged).
10. *Sertularia gracilis* Hincks. Part of branch with gonangium (enlarged).

Plate IV.

Fig. 1. *Sertularia cornicina* (McCready). Colony with gonangia and expanded hydranths. Drawn from life (enlarged).
2. *Sertularia cornicina.* Pair of hydrothecæ (greatly enlarged).
3. *Sertularia cornicina.* Gonangium (enlarged).
4. *Sertularia cornicina.* Side view of colony with parasitic campanularian and its gonangium (enlarged).
5. *Sertularia cornicina.* Part of same colony (enlarged).

Plate V.

Fig. 1. *Sertularia mayeri* Nutting. Basal portion of colony (enlarged).
2. *Sertularia mayeri.* Distal part of stem (enlarged).
3. *Sertularia mayeri.* Side view of stem (enlarged).
4. *Sertularia mayeri.* Hydrothecæ with collapsible tubular extensions (enlarged).
5. *Sertularia pourtalesi* Nutting. Part of stem (enlarged).
6. *Sertularia stookeyi* Nutting. Part of stem and gonangium (enlarged).
7. *Sertularia stookeyi.* Pair of hydrothecæ (greatly enlarged).

Plate VI.

Fig. 1. *Sertularia brevicyathus* Versluys. Part of stem (enlarged).
2. *Sertularia brevicyathus.* Side view of stem (enlarged).
3. *Sertularia flowersi* Nutting. Part of stem (enlarged).
4. *Sertularia flowersi.* Side view of stem (enlarged)
5. *Sertularia tumida* Allman. Pair of hydrothecæ (enlarged). (After Allman.)
6. *Sertularia exigua* Allman. Pair of hydrothecæ (enlarged). (After Allman.)

Plate VII.

Fig. 1. *Thuiaria thuja* (Linnæus). Part of branch (enlarged).
2. *Thuiaria thuja.* Two hydrothecæ (greatly enlarged).
3. *Thuiaria thuja.* Single hydrotheca (greatly enlarged).
4. *Thuiaria elegans* Kirchenpauer. Part of branch (enlarged). (After Kirchenpauer.)
5. *Thuiaria robusta* Clark. Side view of branch (enlarged).
6. *Thuiaria robusta.* Front view of branch (enlarged).
7. *Thuiaria robusta.* Part of branch with gonangia (enlarged).

Plate VIII.

Fig. 1. *Thuiaria thuiarioides* (Clark). Part of stem, showing branch origin (enlarged).
2. *Thuiaria thuiarioides.* Pair of hydrothecæ (greatly enlarged).
3. *Thuiaria thuiarioides.* Single hydrotheca, showing operculum (greatly enlarged).
4. *Thuiaria thuiarioides.* Part of branch (enlarged).
5, 6. *Thuiaria thuiarioides.* Gonangia (enlarged).
7. *Thuiaria polycarpa* (Kirchenpauer). Part of stem, showing branch origin (enlarged).
8. *Thuiaria polycarpa.* Part of branch (enlarged).
9. *Thuiaria polycarpa.* Side view of two hydrothecæ (enlarged).

Plate IX.

Fig. 1. *Thuiaria kurilæ* (Pœppig). Part of branch (enlarged).
2. *Thuiaria kurilæ.* Single hydrotheca, showing margin (greatly enlarged).
3. *Thuiaria immersa* Nutting. Part of branch (enlarged).
4. *Thuiaria immersa.* Hydrothecæ (greatly enlarged).
5. *Thuiaria lonchitis* (Ellis and Solander). Part of branch with gonangia (enlarged).
6, 7, 8. *Thuiaria lonchitis.* Hydrothecæ, showing variation on margin (greatly enlarged).
9. *Thuiaria plumulifera* Allman. Part of branch (enlarged).
10. *Thuiaria plumulifera.* Part of another colony (enlarged).
11. *Thuiaria plumulifera.* Part of main stem, showing branch origin (enlarged).
12, 13. *Thuiaria plumulifera.* Hydrothecæ, showing margin (greatly enlarged).

Plate X.

Fig. 1. *Thuiaria diffusa* (Allman). Part of branch (enlarged).
2. *Thuiaria diffusa.* Two hydrothecæ (greatly enlarged).
3. *Thuiaria diffusa.* Single hydrotheca (greatly enlarged).
4. *Thuiaria dalli* Nutting. Part of branch (enlarged).
5. *Thuiaria dalli.* Part of stem, showing branch origin (enlarged).
6. *Thuiaria dalli.* Two hydrothecæ (greatly enlarged).
7. *Thuiaria similis* (Clark). Part of colony with gonangium (enlarged).
8. *Thuiaria similis.* Hydrothecæ (greatly enlarged).
9. *Thuiaria similis.* Four hydrothecæ (greatly enlarged).

PLATE XI.

FIG. 1. *Thuiaria tubuliformis* (Marktanner-Turneretscher). Part of colony, showing main stem and branch origin (slightly enlarged).
2. *Thuiaria tubuliformis.* Part of branch (enlarged).
3. *Thuiaria tubuliformis.* Part of branch with gonangium (enlarged).
4. *Thuiaria tubuliformis.* Side view of two hydrothecæ (greatly enlarged).
5, 6. *Thuiaria tubuliformis.* Ends of hydrothecæ, showing margins (enlarged).
7, 8. *Thuiaria tubuliformis.* Gonangia (enlarged.)
9. *Thuiaria tenera* (Sars). Part of colony (enlarged).
10. *Thuiaria tenera.* Part of branch (enlarged).
11, 12. *Thuiaria tenera.* Ends of hydrothecæ, showing margins (greatly enlarged).

PLATE XII.

FIG. 1. *Thuiaria fabricii* (Levinsen). Part of branch (enlarged).
2. *Thuiaria fabricii.* Part of branch with gonangia (enlarged).
3. *Thuiaria argentea* (Linnæus). Entire branch, showing ramification (slightly enlarged).
4. *Thuiaria argentea.* Part of branch (enlarged).
5. *Thuiaria argentea.* Distal part of branch (enlarged).
6. *Thuiaria argentea.* Two hydrothecæ (greatly enlarged).
7. *Thuiaria argentea.* Hydranth expanded, drawn from life (greatly enlarged).
8, 9. *Thuiaria argentea.* Gonangia (enlarged).

PLATE XIII.

FIG. 1. *Thuiaria cupressina* (Linnæus). Part of branch (enlarged).
2. *Thuiaria cupressina.* Hydrothecæ (greatly enlarged).
3. *Thuiaria cupressina.* Gonangia (enlarged).
4. *Pasythea quadridentata* (Ellis and Solander). Trophosome (enlarged).
5. *Pasythea quadridentata.* Hydrothecæ and gonangium (greatly enlarged).
6. *Pasythea quadridentata.* Side view of group of hydrothecæ (enlarged).
7. *Pasythea quadridentata.* Side view of two hydrothecæ (greatly enlarged).

PLATE XIV.

FIG. 1. *Sertularella gayi* (Lamouroux). Part of branch (enlarged).
2. *Sertularella gayi.* Part of branch with gonangium (much less enlarged).
3, 4. *Sertularella gayi.* Hydrothecæ, showing operculum (enlarged).
5. *Sertularella gayi.* Gonangium (enlarged).
6. *Sertularella gayi* (var. *robusta* Allman). Part of branch with gonangium (enlarged).
7. *Sertularella gayi* (var. *robusta*). Part of colony overgrown with *Filellum serpens* (enlarged).

PLATE XV.

FIG. 1. *Sertularella conica* Allman. Part of branch (enlarged).
2. *Sertularella conica.* View of margin and operculum (enlarged).
3. *Sertularella catena* (Allman). Part of Allman's type specimen with gonangia (enlarged).
4. *Sertularella quadrata* Nutting. Part of branch (enlarged).
5. *Sertularella quadrata.* Single gonangium with parasitic campanularian (greatly enlarged).
6. *Sertularella quadrata.* Part of branch with gonangia (enlarged).

PLATE XVI.

FIG. 1. *Sertularella tanneri* Nutting. Part of branch (enlarged).
2. *Sertularella geniculata* Hincks (enlarged). (After Hincks.)
3. *Sertularella patagonica* (d'Orbigny) (enlarged). (After d'Orbigny.)

PLATE XVII.

FIG. 1. *Sertularella rugosa* (Linnæus). Part of branching colony (enlarged).
2. *Sertularella rugosa.* Colony with gonosome (enlarged). (After Nutting.)
3. *Sertularella rugosa.* Three hydrothecæ (greatly enlarged). (After Nutting.)
4. *Sertularella rugosa.* Single hydrotheca (greatly enlarged). (After Nutting.)
5. *Sertularella rugosa.* Top of gonangium, showing teeth (enlarged). (After Nutting.)
6. *Sertularella areyi* Nutting. Part of colony (enlarged).

Plate XVIII.

Fig. 1. *Sertularella tenella* (Alder). Part of colony (enlarged).
2. *Sertularella tenella.* End of hydrotheca, showing operculum (greatly enlarged).
3. *Sertularella allmani* Hartlaub. Part of colony (enlarged).
4, 5. *Sertularella allmani.* Hydrothecæ, showing margin and operculum (greatly enlarged).
6. *Sertularella allmani.* Gonangium (enlarged).
7. *Sertularella contorta* Kirchenpauer. Part of branch (enlarged).
8. *Sertularella contorta.* Hydrotheca, showing margin (greatly enlarged).
9. *Sertularella contorta.* Gonangium (enlarged).
10. *Sertularella lata* (Bale). Part of branch (enlarged).

Plate XIX.

Fig. 1. *Sertularella albida* Kirchenpauer. Part of branch (enlarged).
2. *Sertularella albida.* Branch with gonangium (much less enlarged).
3. *Sertularella pinnigera* Hartlaub. Part of branch, showing hydranths (enlarged). (After Allman.)
4. *Sertularella cylindritheca* (Allman). Part of branch (enlarged). (From Allman's type specimen.)
5. *Sertularella distans* (Allman). Part of branch (enlarged).
6. *Sertularella distans.* Two hydrothecæ (greatly enlarged).
7. *Sertularella gigantea* Mereschkowsky (slightly enlarged). (After Mereschkowsky.)

Plate XX.

Fig. 1. *Sertularella amphorifera* Allman. Part of branch (enlarged).
2. *Sertularella amphorifera.* End of hydrotheca (greatly enlarged).
3. *Sertularella fusiformis* Hincks (enlarged). (After Hincks.)
4. *Sertularella fusiformis.* Gonangium (enlarged). (After Hincks.)
5. *Sertularella picta* (Meyen). Part of colony (enlarged). (After Meyen.)
6. *Sertularella picta.* Single hydrotheca (greatly enlarged). (After Hartlaub.)
7. *Sertularella picta.* Part of branch with gonangium (enlarged). (After Hartlaub.)
8. *Sertularella megastoma* Nutting. Part of branch (enlarged).
9. *Sertularella megastoma.* Part of branch with gonangium (enlarged).
10, 11. *Sertularella solitaria* Nutting. Single hydrothecæ (enlarged).

Plate XXI.

Fig. 1. *Sertularella polyzonias* (Ellis and Solander). Part of branch (enlarged).
2. *Sertularella polyzonias.* Gonangium (enlarged).
3. *Sertularella clausa* (Allman). Part of branch from Allman's type (enlarged).
4. *Sertularella clausa.* End of hydrotheca, showing operculum, from Allman's type (greatly enlarged).
5. *Sertularella complexa* Nutting. Part of branch (enlarged).
6. *Sertularella complexa.* End of hydrotheca, showing operculum (greatly enlarged).
7. *Sertularella complexa.* Gonangium (enlarged).
8, 9. *Sertularella complexa.* Gonangia viewed from above, showing teeth (enlarged).
10. *Sertularella pinnata* Clark. Part of colony with gonangia (enlarged).
11. *Sertularella pinnata.* Part of branch, front view (enlarged).
12. *Sertularella pinnata.* Single hydrotheca (greatly enlarged).

Plate XXII.

Fig. 1. *Sertularella margaritacea* Allman. Part of branch with gonangium (enlarged). (After Allman.)
2. *Sertularella turgida* (Trask). Part of colony with gonangium (enlarged).
3. *Sertularella turgida.* Distal part of branch (enlarged).
4, 5. *Sertularella turgida.* Ends of hydrothecæ, showing teeth (greatly enlarged).
6. *Sertularella sieboldi* Kirchenpauer. Part of branch (enlarged). (After Kirchenpauer.)
7. *Sertularella sieboldi.* Gonangium (enlarged). (After Kirchenpauer.)
8. *Sertularella subdichotoma* Kirchenpauer. Part of colony, showing branching (enlarged).
9. *Sertularella subdichotoma.* Hydrotheca, showing margin (greatly enlarged).
10. *Sertularella subdichotoma.* End of hydrotheca, showing operculum (greatly enlarged).
11, 12. *Sertularella subdichotoma.* Gonangia (enlarged).

Plate XXIII.

Fig. 1. *Sertularella filiformis* (Allman). Branch with gonangium, from Allman's type specimen (enlarged).
2, 3. *Sertularella filiformis.* Hydrothecæ, from same specimen (greatly enlarged).
4. *Sertularella quadrifida* Hartlaub. Part of Allman's type of *Sertularia quadridens* Allman (enlarged).
5. *Sertularella quadrifida.* Three hydrothecæ from same specimen (greatly enlarged).
6, 7. *Sertularella quadrifida.* Hydrothecæ from same specimen, showing teeth and opercula (greatly enlarged).
8. *Sertularella meridionalis* Nutting. Part of branch with gonangium (enlarged).
9. *Sertularella meridionalis.* Single hydrotheca, showing teeth and operculum (enlarged).

Plate XXIV.

Fig. 1. *Sertularella elegans* Nutting. Part of colony with gonangium (enlarged).
2. *Sertularella milneana* (d'Orbigny). Part of branch (enlarged).
3, 4. *Sertularella milneana.* Ends of hydrothecæ, showing teeth and opercula (greatly enlarged).
5. *Sertularella milneana.* Gonangium (enlarged).
6. *Sertularella magellanica* (Marktanner-Turneretscher). Lower part of colony (enlarged).
7. *Sertularella magellanica.* Distal part of colony (enlarged).
8. *Sertularella magellanica.* End of hydrotheca, showing teeth (enlarged).
9. *Sertularella minuta* Nutting. Part of colony with gonangium (enlarged).
10. *Sertularella minuta.* End of hydrotheca, showing teeth (greatly enlarged).

Plate XXV.

Fig. 1. *Sertularella dentifera* Torrey. Part of colony (enlarged). (After Torrey.)
2. *Sertularella dentifera.* Two hydrothecæ, showing reduplicated margins (enlarged). (After Torrey.)
3. *Sertularella tricuspidata* (Alder). Part of colony (enlarged).
4, 5. *Sertularella tricuspidata.* Gonangia (enlarged).
6. *Sertularella tricuspidata* (large form from Alaska). (Part of colony enlarged.)
7. *Sertularella tricuspidata.* Single hydrotheca (greatly enlarged).

Plate XXVI.

Fig. 1. *Sertularella levinseni* Nutting. Part of colony with gonangia (enlarged).
2. *Sertularella levinseni.* End of hydrotheca (greatly enlarged).
3. *Sertularella tropica* Hartlaub. Part of colony (enlarged). (After Clarke.)
4. *Sertularella tropica.* Gonangium (enlarged). (After Clarke.)
5. *Sertularella clarkii* Mereschkowsky. Part of colony (enlarged). (After Mereschkowsky.)
6. *Sertularella nana* Hartlaub. Part of branch (enlarged). (After Hartlaub.)
7 *Sertularella episcopus* Allman. Part of colony with gonangia (enlarged). (After Allman.)

Plate XXVII.

Fig. 1. *Sertularella magna* Nutting. Two hydrothecæ (much less enlarged than other figures).
2. *Sertularella formosa* Fewkes. Branch overgrown with parasitic campanularian (enlarged).
3. *Sertularella formosa.* Part of Allman's type of *Sertularia integritheca* Allman (enlarged).
4. *Sertularella formosa.* Part of stem with gonangia (enlarged).
5. *Sertularella hartlaubi* Nutting. Part of stem showing branch origins (enlarged).

Plate XXVIII.

Fig. 1. *Dictyocladium flabellum* Nutting. Part of colony with gonangia (enlarged).
2. *Dictyocladium flabellum.* Part of branch (enlarged).
3. *Dictyocladium flabellum.* End of hydrotheca, showing teeth and operculum (enlarged).
4. *Diphasia rosacea* (Linnæus). Branch with female gonangium (enlarged).
5. *Diphasia rosacea.* Side view of branch with gonangium (enlarged).
6. *Diphasia tamarisca* (Linnæus). Two pairs of hydrothecæ (enlarged). (After Hincks.)
7. *Diphasia tamarisca.* Portion of colony with gonangia (enlarged). (After Hincks.)

Plate XXIX.

Fig. 1. *Diphasia corniculata* (Murray). Part of colony (enlarged). (After Murray.)
2. *Diphasia fallax* (Johnston). Part of colony, showing branching (enlarged).
3. *Diphasia fallax.* Front view of branch (enlarged).
4. *Diphasia fallax.* Part of branch with gonangium (enlarged).
5. *Diphasia fallax.* Pair of hydrothecæ (greatly enlarged).
6. *Diphasia fallax.* End of hydrotheca, showing operculum (greatly enlarged).

Plate XXX.

Fig. 1. *Diphasia tropica* Nutting. Part of colony (enlarged).
2. *Diphasia digitalis* (Busk). Front view of branch (enlarged).
3. *Diphasia digitalis.* Side view of branch (enlarged).
4. *Diphasia digitalis.* Part of Allman's type of *Desmoscyphus acanthocarpus* Allman (enlarged).
5. *Diphasia digitalis.* Distal ends of two hydrothecæ, showing the hood-like operculum (greatly enlarged).
6. *Diphasia digitalis.* Single hydrotheca, showing what appear to be opercular muscles (greatly enlarged).
7. *Diphasia digitalis.* Gonangium (enlarged).

Plate XXXI.

Fig. 1. *Diphasia pulchra* Nutting. Two hydrothecæ (greatly enlarged).
2. *Diphasia pulchra*. Part of colony (enlarged).
3. *Diphasia pulchra*. Part of branch (enlarged).
4. *Diphasia paarmanni* Nutting. Part of branch with male gonangia (enlarged).
5. *Diphasia paarmanni*. Female gonangium (enlarged).
6. *Diphasia paarmanni*. End of hydrotheca, showing operculum (much enlarged).
7. *Diphasia kincaidi* (Nutting). Distal end of branch, with gonangia (enlarged).
8. *Diphasia kincaidi*. Four hydrothecæ (greatly enlarged).
9. *Diphasia kincaidi*. Gonangium (greatly enlarged).

Plate XXXII.

Fig. 1. *Abietinaria abietina* (Linnæus). Part of colony (enlarged).
2. *Abietinaria abietina*. Part of a branch (much less magnified).
3. *Abietinaria abietina*. Two hydrothecæ, showing operculum (much enlarged).
4. *Abietinaria variabilis* (Clark). Part of colony, showing branching (enlarged).
5. *Abietinaria variabilis*. Four hydrothecæ (much enlarged).
6. *Abietinaria variabilis*. Group of gonangia (enlarged).
7. *Abietinaria variabilis*. Gonangium (greatly enlarged).

Plate XXXIII.

Fig. 1. *Abietinaria inconstans* (Clark). Part of colony (enlarged).
2. *Abietinaria inconstans*. Part of branch (enlarged).
3. *Abietinaria coei* (Nutting). Part of branch, with gonangia (enlarged).
4. *Abietinaria coei*. Single hydrotheca, showing sinuation of margin (enlarged).
5. *Abietinaria coei*. Top-shaped gonangium (enlarged).
6. *Abietinaria traski* (Torrey). Part of colony, showing branching (enlarged).
7. *Abietinaria traski*. Two hydrothecæ (greatly enlarged).
8, 9. *Abietinaria traski*. Ends of hydrothecæ, showing opercula (greatly enlarged).
10. *Abietinaria traski*. Branch, with gonangium (enlarged).
11. *Abietinaria traski*. Three hydrothecæ from another colony (greatly enlarged).

Plate XXXIV.

Fig. 1. *Abietinaria filicula* (Ellis and Solander). Part of branch (much enlarged).
2. *Abietinaria amphora* Nutting. Part of branch (enlarged).
3. *Abietinaria amphora*. Distal part of branch (enlarged).
4. *Abietinaria amphora*. Part of branch, with gonangium (enlarged).
5. *Abietinaria anguina* (Trask). Part of branch, with very slender hydrothecæ (enlarged).
6. *Abietinaria anguina*. Part of branch with gonangia (enlarged).
7. *Abietinaria anguina*. Single gonangium (enlarged).

Plate XXXV.

Fig. 1. *Abietinaria gracilis* Nutting. Part of colony with gonangium (enlarged).
2. *Abietinaria gracilis*. Four hydrothecæ (greatly enlarged).
3. *Abietinaria compressa* (Mereschkowsky). Part of branch (enlarged). (After Mereschkowsky.)
4. *Abietinaria compressa*. Single hydrothecæ (much enlarged). (After Mereschkowsky.)
5. *Abietinaria alexanderi* Nutting. Part of stem and branches (enlarged).
6. *Abietinaria alexanderi*. Part of branch and gonangium (enlarged).
7. *Abietinaria alexanderi*. Gonangium, showing meridional lines (enlarged).
8. *Abietinaria alexanderi*. Gonangium (much enlarged).

Plate XXXVI.

Fig. 1. *Abietinaria greenei* (Murray). Part of branch (enlarged).
2. *Abietinaria greenei*. Four hydrothecæ (enlarged).
3. *Abietinaria greenei*. Pair of hydrothecæ with toothed margins (much enlarged).
4. *Abietinaria greenei*. Pair of hydrothecæ with even margins (much enlarged).
5. *Abietinaria greenei*. Side view of hydrothecæ (enlarged).
6. *Abietinaria greenei*. Side view of hydrothecæ (much enlarged).
7, 8. *Abietinaria greenei*. Gonangia (enlarged).
9. *Abietinaria costata* (Nutting). Part of branch (enlarged).
10. *Abietinaria costata*. Part of main stem, showing branch origins (enlarged).

Fig. 11. *Abietinaria costata.* Four hydrothecæ (much enlarged).
12. *Abietinaria costata.* Group of gonangia (enlarged).
13. *Abietinaria annulata* (Kirchenpauer). Part of main stem and branches (enlarged).
14. *Abietinaria annulata.* Part of branch (enlarged).
15. *Abietinaria annulata.* Side view of three hydrothecæ (enlarged).

Plate XXXVII.

Fig. 1. *Abietinaria turgida* (Clark). Part of stem and branch (enlarged).
2. *Abietinaria turgida.* Gonangium (enlarged).
3. *Abietinaria gigantea* (Clark). Part of branch (enlarged).
4. *Abietinaria gigantea.* Side view of branch with gonangia (enlarged).
5. *Abietinaria gigantea.* Side view of three hydrothecæ (enlarged).

Plate XXXVIII.

Fig. 1. *Hydrallmania falcata* (Linnæus). Side view of branch (greatly enlarged).
2. *Hydrallmania falcata.* Gonangium (enlarged).
3. *Hydrallmania falcata.* Front view of end of branch (enlarged).
4. *Hydrallmania falcata.* Side view of end of branch (enlarged).
5. *Hydrallmania distans* Nutting. Part of branch, side view (enlarged).
6. *Hydrallmania distans.* Front view of branch (enlarged).
7,8. *Hydrallmania distans.* Front view of hydrothecæ (much enlarged).
9. *Hydrallmania distans.* Gonangium (enlarged).
10. *Hydrallmania franciscana* (Trask). Part of colony (enlarged). (After Trask.)
11. *Selaginopsis mirabilis* (Verrill). Part of branch (enlarged).
12. *Selaginopsis mirabilis.* Gonangium (enlarged).
13. *Selaginopsis pinaster* (Lepechin). Part of branch (enlarged). (After Kirchenpauer.)

Plate XXXIX.

Fig. 1. *Selaginopsis triserialis* Mereschkowsky. Part of branch (enlarged).
2. *Selaginopsis triserialis.* Basal part of branch (enlarged).
3. *Selaginopsis plumiformis* Nutting. Part of main stem, branch and branchlets, showing manner of branching (enlarged).
4. *Selaginopsis obsoleta* (Lepechin). Part of branch (enlarged).
5. *Selaginopsis obsoleta.* Cross section of branch (enlarged).
6. *Selaginopsis pinnata* Mereschkowsky. Part of branch (enlarged).
7. *Selaginopsis cylindrica* (Clark). Part of branch (enlarged).
8. *Selaginopsis cylindrica.* Single hydrotheca (greatly enlarged).

Plate XL.

Fig. 1. *Selaginopsis ornata* Nutting. Part of stem, showing canaliculated cœnosarc (enlarged).
2. *Selaginopsis ornata.* Part of branch (enlarged).
3. *Selaginopsis ornata.* Gonangium (enlarged).
4. *Selaginopsis obsoleta* (Lepechin). Part of branch (enlarged). (After Kirchenpauer.)
5. *Selaginopsis alternitheca* (Levinsen). Front view of part of branch (enlarged).
6. *Selaginopsis alternitheca.* Side view of part of branch (enlarged).
7. *Selaginopsis alternitheca.* Gonangium (enlarged).
8. *Selaginopsis hartlaubi* Nutting. Part of branch (enlarged).

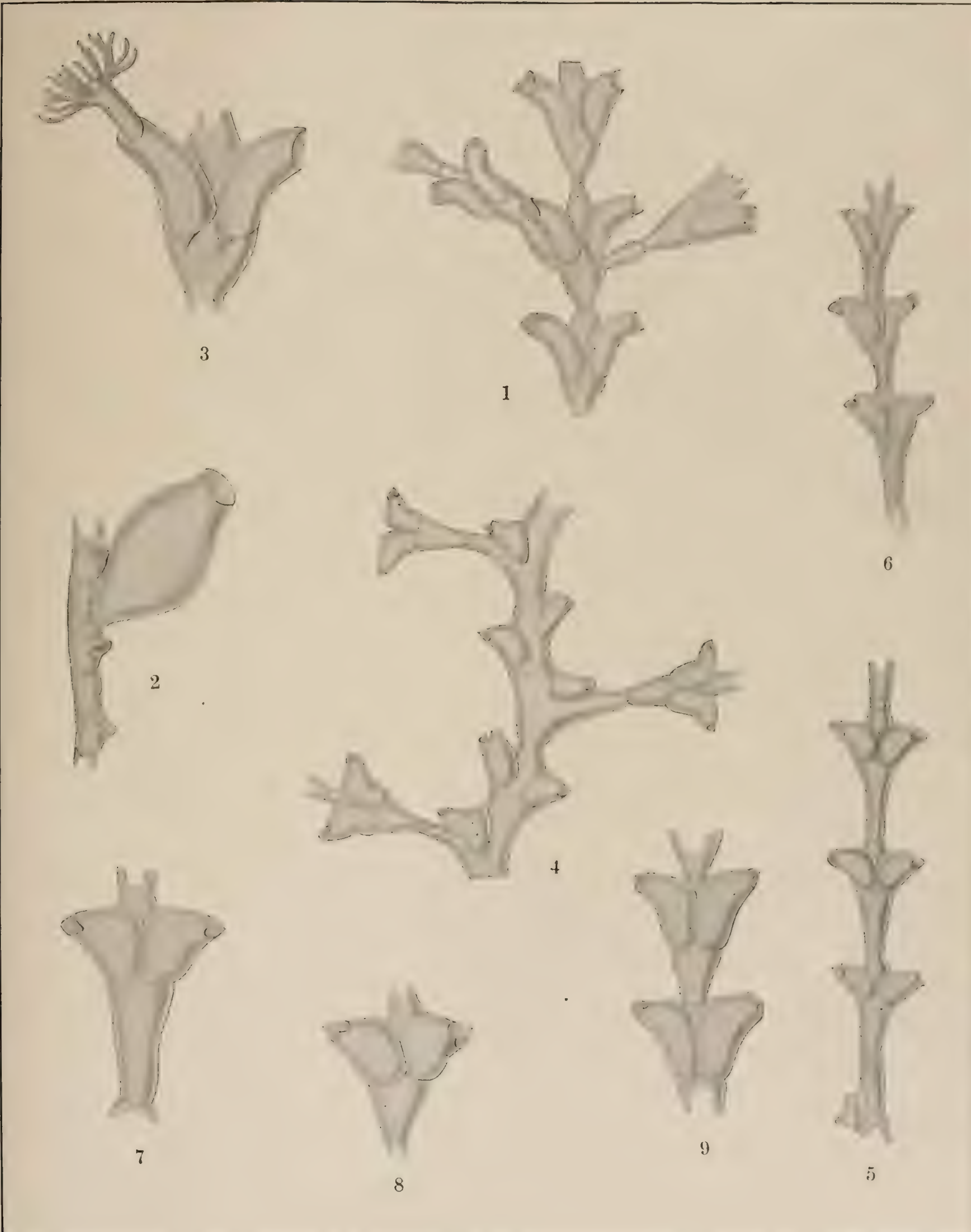
Plate XLI.

Fig. 1. *Synthecium tubithecum* (Allman). Part of colony, showing opposite branches (enlarged).
2. *Synthecium rectum* Nutting. Part of colony (enlarged).
3. *?Synthecium marginatum* (Allman). Part of branch (enlarged). (After Allman.)
4. *Synthecium robustum* Nutting. Part of colony with gonangia (less enlarged).
5. *Synthecium robustum.* Part of branch, front view (enlarged).
6. *Synthecium robustum.* Part of branch, side view (enlarged).
7. *Synthecium cylindricum* (Bale). Part of branch (enlarged). (After Bale.)

EXPLANATION TO PLATE I.

FIG. 1. *Sertularia pumila* Linnæus. Portion of main stem and branches (enlarged).

2. *Sertularia pumila.* Side view of branch, showing gonangium (enlarged).
3. *Sertularia pumila.* Pair of hydrothecæ and expanded hydranth (greatly enlarged)
4. *Sertularia versluysi* Nutting. Portion of main stem and branches (enlarged).
5. *Sertularia versluysi.* Part of branch (enlarged).
6. *Sertularia versluysi.* Branch from another colony (enlarged).
7, 8, 9. *Sertularia versluysi.* Pairs of hydrothecæ (greatly enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE II.

FIG. 1. *Sertularia challengeri* Nutting. Portion of stem and branches from Allman's type of *Desmoscyphus pectinatus* Allman (enlarged).

2. *Sertularia challengeri.* Part of branch from same specimen (greatly enlarged).
3. *Sertularia operculata* Linnæus. Portion of branch with gonangium (enlarged).
4. *Sertularia operculata.* A pair of hydrothecæ (greatly enlarged).
5. *Sertularia operculata.* Side view of hydrotheca (greatly enlarged).
6. *Sertularia pulchella* (d'Orbigny). Portion of branch with gonangium (enlarged). (After d'Orbigny.)
7. *Sertularia pulchella.* Part of branch with gonangium (enlarged). (After Clarke's drawing of *Sertularia furcata* Trask.)
8. *Sertularia bispinosa* (Gray). Part of branch (enlarged).
9. *Sertularia bispinosa.* Pair of hydrothecæ (greatly enlarged).
10. *Sertularia bispinosa.* Side view of branch (enlarged).
11. *Sertularia bispinosa.* Side view of hydrotheca (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE III.

Fig. 1. *Sertularia desmoides* Torrey. Part of branch (enlarged).

2. *Sertularia desmoides.* Pair of hydrothecæ (greatly enlarged).

3. *Sertularia desmoides.* End of hydrotheca, showing aperture (greatly enlarged).

4. *Sertularia rathbuni* Nutting. Portion of branch (enlarged).

5. *Sertularia rathbuni.* Pair of hydrothecæ (greatly enlarged).

6, 7. *Sertularia rathbuni.* Lateral views of hydrothecæ, showing tridentate margins (greatly enlarged).

8, 9. *Sertularia rathbuni.* Two other views of margins (greatly enlarged).

10. *Sertularia gracilis* Hincks. Part of branch with gonangium (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE IV.

FIG. 1. *Sertularia cornicina* (McCready). Colony with gonangia and expanded hydranths. Drawn from life (enlarged).

2. *Sertularia cornicina*. Pair of hydrothecæ (greatly enlarged).
3. *Sertularia cornicina*. Gonangium (enlarged).
4. *Sertularia cornicina*. Side view of colony with parasitic campanularian and its gonangium (enlarged).
5. *Sertularia cornicina*. Part of same colony (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE V.

FIG. 1. *Sertularia mayeri* Nutting. Basal portion of colony (enlarged).

2. *Sertularia mayeri.* Distal part of stem (enlarged).
3. *Sertularia mayeri.* Side view of stem (enlarged).
4. *Sertularia mayeri.* Hydrothecæ with collapsible tubular extensions (enlarged).
5. *Sertularia pourtalesi* Nutting. Part of stem (enlarged).
6. *Sertularia stookeyi* Nutting. Part of stem and gonangium (enlarged).
7. *Sertularia stookeyi.* Pair of hydrothecæ (greatly enlarged).

SERTULARIDÆ.

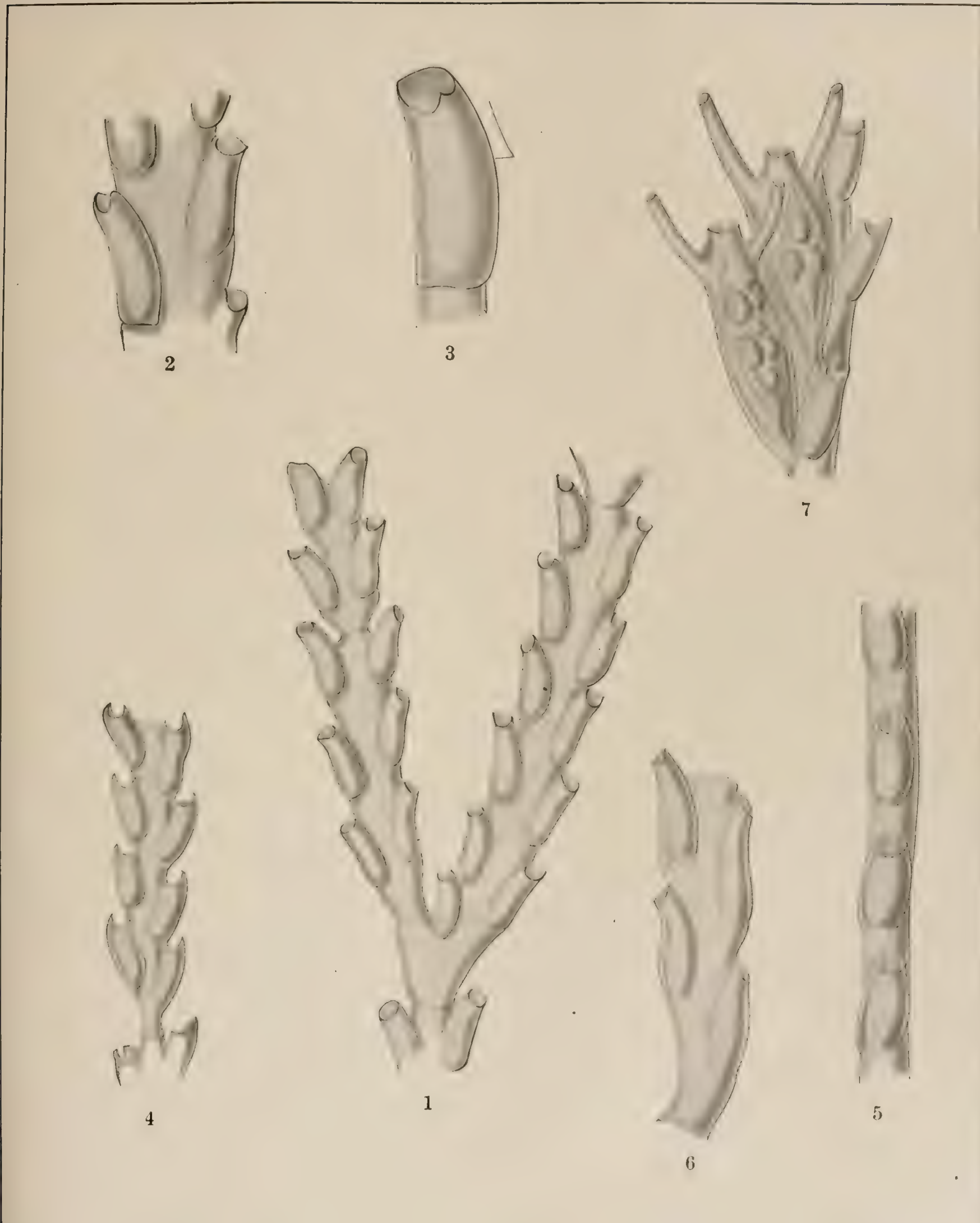
EXPLANATION TO PLATE VI.

Fig. 1. *Sertularia brevicyathus* Versluys. Part of stem (enlarged).
2. *Sertularia brevicyathus.* Side view of stem (enlarged).
3. *Sertularia flowersi* Nutting. Part of stem (enlarged).
4. *Sertularia flowersi.* Side view of stem (enlarged).
5. *Sertularia tumida* Allman. Pair of hydrothecæ (enlarged). (After Allman.)
6. *Sertularia exigua* Allman. Pair of hydrothecæ (enlarged). (After Allman.)

SERTULARIDÆ.

EXPLANATION TO PLATE VII.

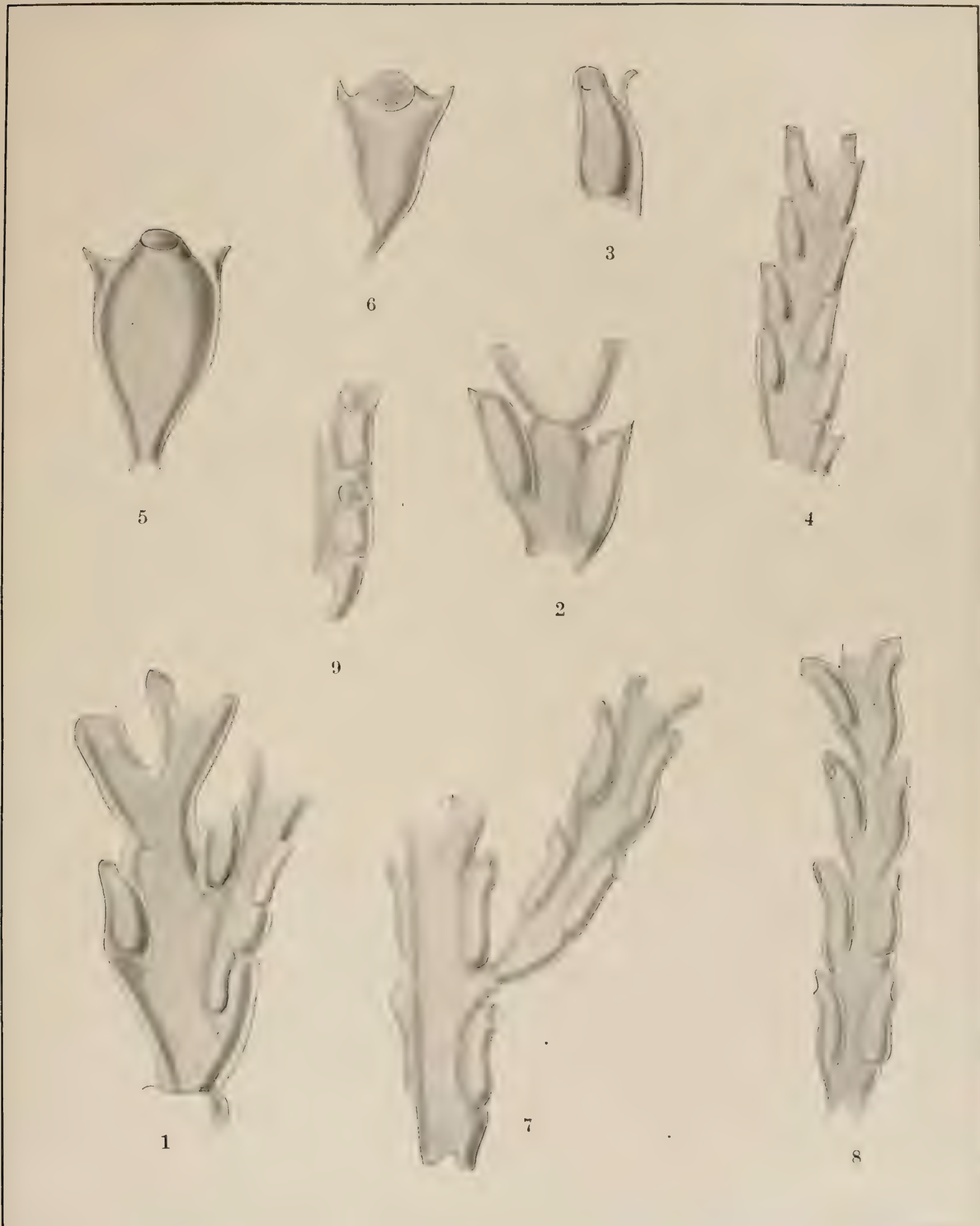
FIG. 1. *Thuiaria thuja* (Linnæus). Part of branch (enlarged).
2. *Thuiaria thuja.* Two hydrothecæ (greatly enlarged).
3. *Thuiaria thuja.* Single hydrotheca (greatly enlarged).
4. *Thuiaria elegans* Kirchenpauer. Part of branch (enlarged). (After Kirchenpauer.)
5. *Thuiaria robusta* Clark. Side view of branch (enlarged).
6. *Thuiaria robusta.* Front view of branch (enlarged).
7. *Thuiaria robusta.* Part of branch with gonangia (enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE VIII.

Fig. 1. *Thuiaria thuiarioides* (Clark). Part of stem, showing branch origin (enlarged).
2. *Thuiaria thuiarioides.* Pair of hydrothecæ (greatly enlarged).
3. *Thuiaria thuiarioides.* Single hydrotheca, showing operculum (greatly enlarged).
4. *Thuiaria thuiarioides.* Part of branch (enlarged).
5, 6. *Thuiaria thuiarioides.* Gonangia (enlarged).
7. *Thuiaria polycarpa* (Pœppig). Part of stem, showing branch origin (enlarged).
8. *Thuiaria polycarpa.* Part of branch (enlarged).
9. *Thuiaria polycarpa.* Side view of two hydrothecæ (enlarged).



SERTULARIDÆ.

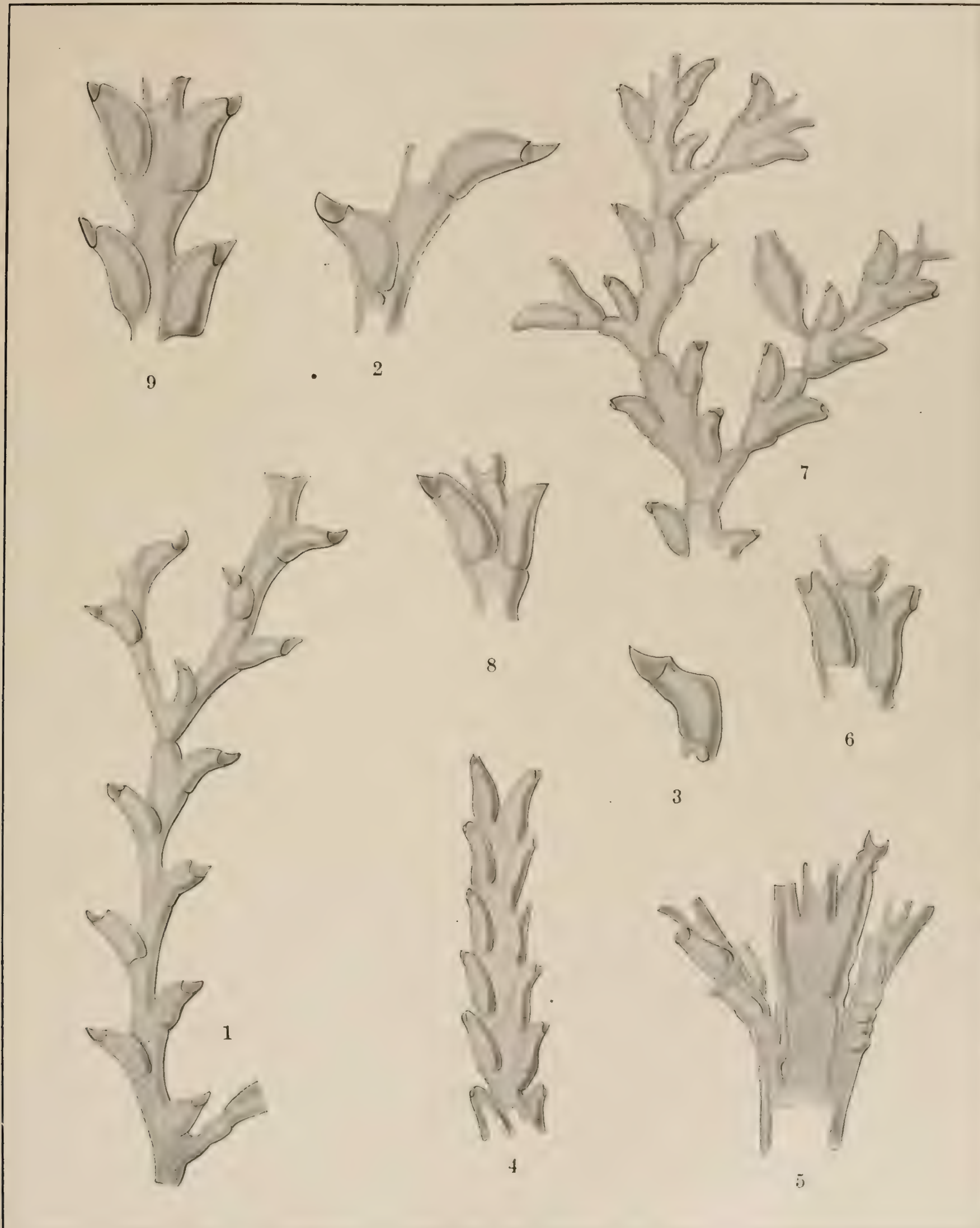
EXPLANATION TO PLATE IX.

FIG. 1. *Thuiaria kurilæ* (Pœppig). Part of branch (enlarged).
2. *Thuiaria kurilæ*. Single hydrotheca, showing margin (greatly enlarged).
3. *Thuiaria immersa* Nutting. Part of branch (enlarged).
4. *Thuiaria immersa*. Hydrothecæ (greatly enlarged).
5. *Thuiaria lonchitis* (Ellis and Solander). Part of branch with gonangia (enlarged).
6, 7, 8. *Thuiaria lonchitis*. Hydrothecæ, showing variation in margin (greatly enlarged).
9. *Thuiaria plumulifera* Allman. Part of branch (enlarged).
10. *Thuiaria plumulifera*. Part of another colony (enlarged).
11. *Thuiaria plumulifera*. Part of main stem, showing branch origin (enlarged).
12, 13. *Thuiaria plumulifera*. Hydrothecæ, showing margin (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE X.

FIG. 1. *Thuiaria diffusa* (Allman). Part of branch (enlarged).
2. *Thuiaria diffusa.* Two hydrothecæ (greatly enlarged).
3. *Thuiaria diffusa.* Single hydrotheca (greatly enlarged).
4. *Thuiaria dalli* Nutting. Part of branch (enlarged).
5. *Thuiaria dalli.* Part of stem, showing branch origin (enlarged).
6. *Thuiaria dalli.* Two hydrothecæ (greatly enlarged).
7. *Thuiaria similis* (Clark). Part of colony with gonangium (enlarged).
8. *Thuiaria similis.* Hydrothecæ (greatly enlarged).
9. *Thuiaria similis.* Four hydrothecæ (greatly enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XI.

FIG. 1. *Thuiaria tubuliformis* (Marktanner-Turneretscher). Part of colony, showing main stem and branch origin (slightly enlarged).

2. *Thuiaria tubuliformis.* Part of branch (enlarged).
3. *Thuiaria tubuliformis.* Part of branch with gonangium (enlarged).
4. *Thuiaria tubuliformis.* Side view of two hydrothecæ (greatly enlarged).

5, 6. *Thuiaria tubuliformis.* Ends of hydrothecæ, showing margins (enlarged).

7, 8. *Thuiaria tubuliformis.* Gonangia (enlarged).

9. *Thuiaria tenera* (Sars). Part of colony (enlarged).

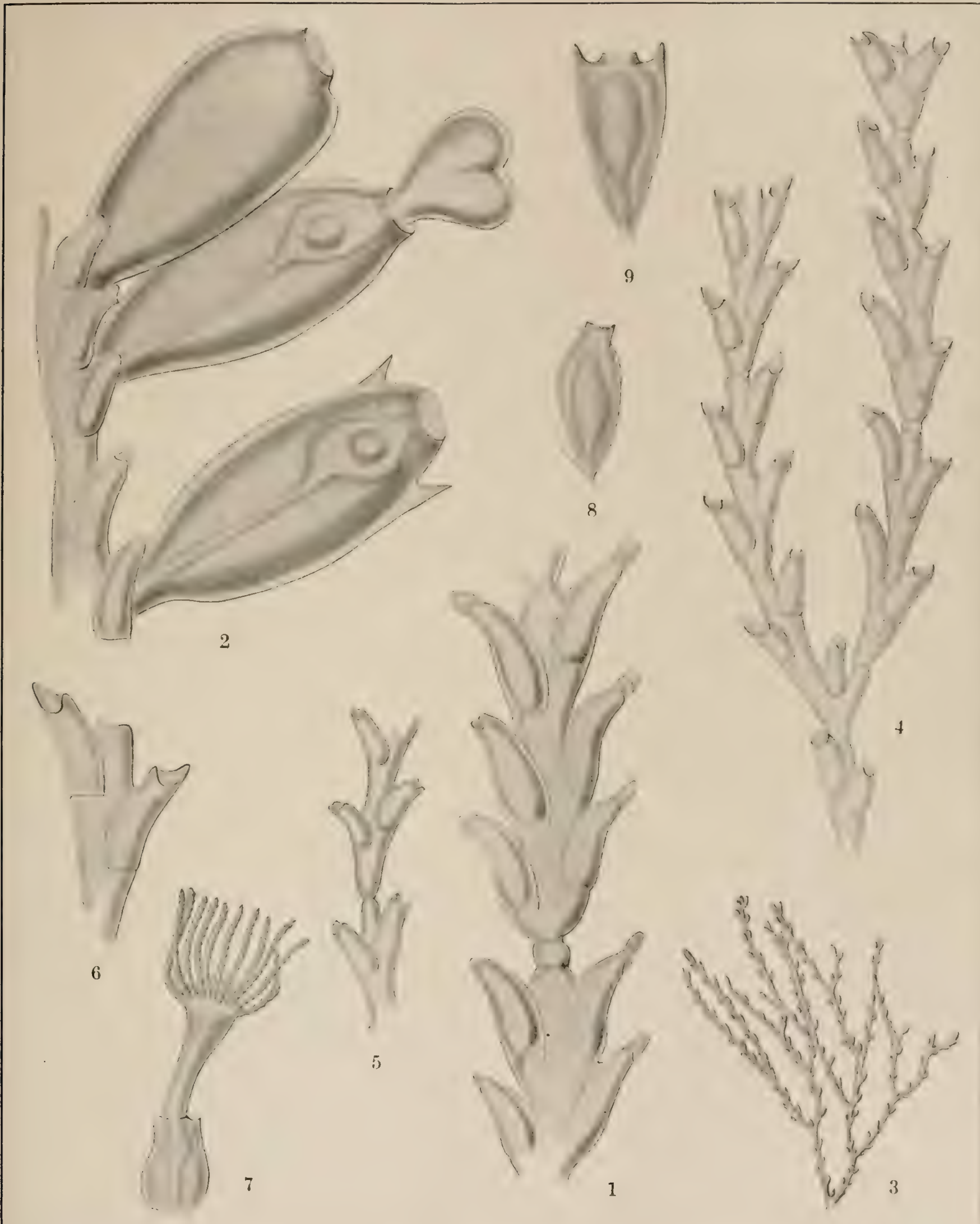
10. *Thuiaria tenera.* Part of branch (enlarged).

11, 12. *Thuiaria tenera.* Ends of hydrothecæ, showing margins (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XII.

Fig. 1. *Thuiaria fabricii* (Levinsen). Part of branch (enlarged).
2. *Thuiaria fabricii.* Part of branch with gonangia (enlarged).
3. *Thuiaria argentea* (Linnæus). Entire branch, showing ramification (slightly enlarged).
4. *Thuiaria argentea.* Part of branch (enlarged).
5. *Thuiaria argentea.* Distal part of branch (enlarged).
6. *Thuiaria argentea.* Two hydrothecæ (greatly enlarged).
7. *Thuiaria argentea.* Hydranth expanded, drawn from life (greatly enlarged).
8, 9. *Thuiaria argentea.* Gonangia (enlarged).



Sertularidæ.

EXPLANATION TO PLATE XIII.

FIG. 1. *Thuiaria cupressina* (Linnæus). Part of branch (enlarged).
2. *Thuiaria cupressina*. Hydrothecæ (greatly enlarged).
3. *Thuiaria cupressina*. Gonangia (enlarged).
4. *Pasythea quadridentata* (Ellis and Solander). Trophosome (enlarged).
5. *Pasythea quadridentata*. Hydrothecæ and gonangium (greatly enlarged).
6. *Pasythea quadridentata*. Side view of group of hydrothecæ (enlarged).
7. *Pasythea quadridentata*. Side view of two hydrothecæ (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XIV.

FIG. 1. *Sertularella gayi* (Lamouroux). Part of branch (enlarged).

2. *Sertularella gayi.* Part of branch with gonangium (much less enlarged).

3, 4. *Sertularella gayi.* Hydrothecæ, showing operculum (enlarged).

5. *Sertularella gayi.* Gonangium (enlarged).

6. *Sertularella gayi* (var. *robusta* Allman). Part of branch with gonangium (enlarged).

7. *Sertularella gayi* (var. *robusta*). Part of colony overgrown with *Filellum serpens* (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XV.

FIG. 1. *Sertularella conica* Allman. Part of branch (enlarged).
2. *Sertularella conica.* View of margin and operculum (enlarged).
3. *Sertularella catena* (Allman). Part of Allman's type specimen with gonangia (enlarged).
4. *Sertularella quadrata* Nutting. Part of branch (enlarged).
5. *Sertularella quadrata.* Single gonangium with parasitic campanularian (greatly enlarged).
6. *Sertularella quadrata.* Part of branch with gonangia (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XVI.

Fig. 1. *Sertularella tanneri* Nutting. Part of branch (enlarged).
2. *Sertularella geniculata* Hincks (enlarged). (After Hincks.)
3. *Sertularella patagonica* (d'Orbigny) (enlarged). (After d'Orbigny.)

Sertularidæ.

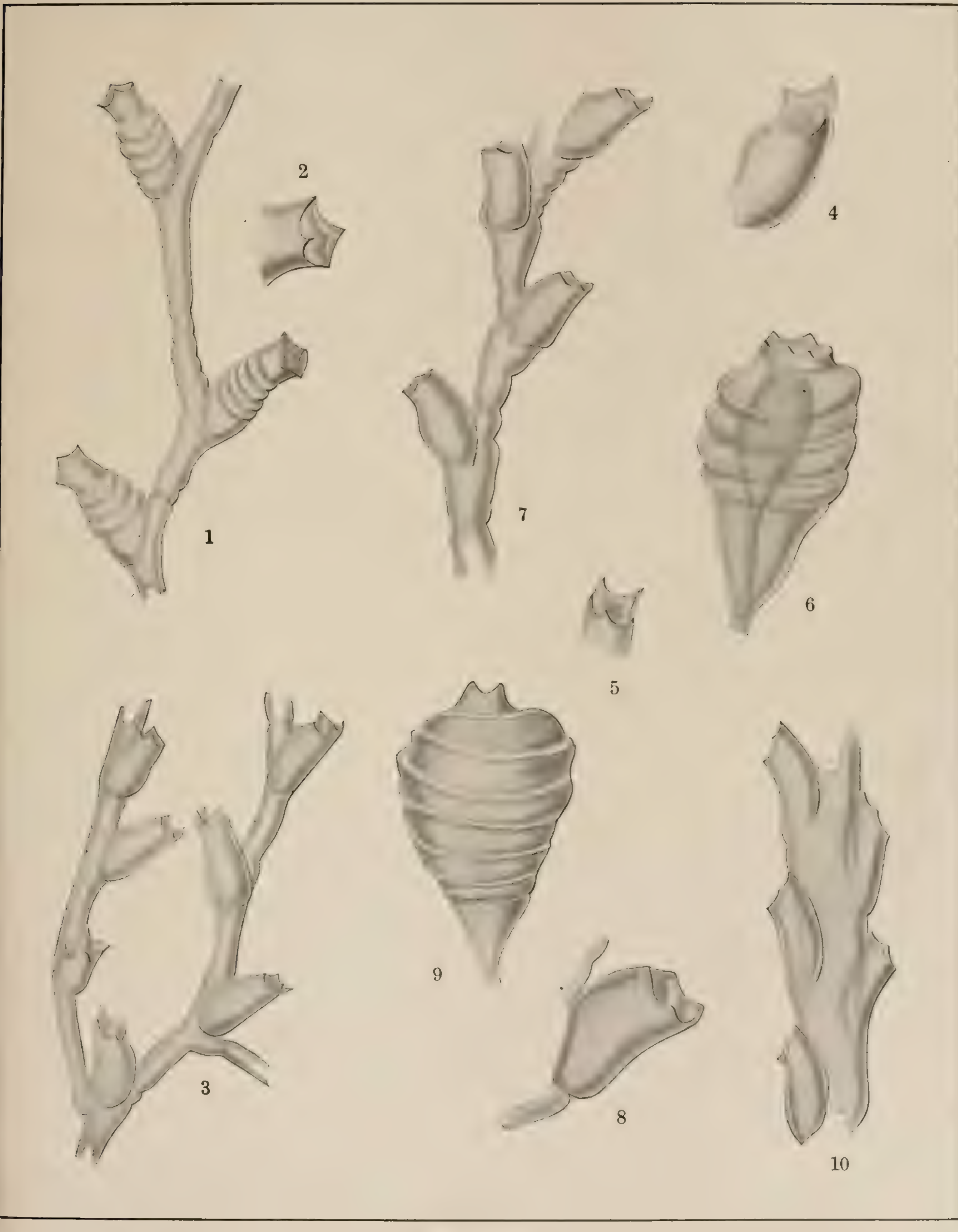
EXPLANATION TO PLATE XVII.

FIG. 1. *Sertularella rugosa* (Linnæus). Part of branching colony (enlarged).
2. *Sertularella rugosa*. Colony with gonosome (enlarged). (After Nutting.)
3. *Sertularella rugosa*. Three hydrothecæ (greatly enlarged). (After Nutting.)
4. *Sertularella rugosa*. Single hydrotheca (greatly enlarged). (After Nutting.)
5. *Sertularella rugosa*. Top of gonangium, showing teeth (enlarged). (After Nutting.)
6. *Sertularella areyi* Nutting. Part of colony (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XVIII.

FIG. 1. *Sertularella tenella* (Alder). Part of colony (enlarged).
2. *Sertularella tenella*. End of hydrotheca, showing operculum (greatly enlarged).
3. *Sertularella allmani* Hartlaub. Part of colony (enlarged).
4, 5. *Sertularella allmani*. Hydrothecæ, showing margin and operculum (greatly enlarged).
6. *Sertularella allmani*. Gonangium (enlarged).
7. *Sertularella contorta* Kirchenpauer. Part of branch (enlarged).
8. *Sertularella contorta*. Hydrotheca, showing margin (greatly enlarged).
9. *Sertularella contorta*. Gonangium (enlarged).
10. *Sertularella lata* (Bale). Part of branch (enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XIX.

FIG. 1. *Sertularella albida* Kirchenpauer. Part of branch (enlarged).
2. *Sertularella albida.* Branch with gonangium (much less enlarged).
3. *Sertularella pinnigera* Hartlaub. Part of branch showing hydranths (enlarged). (After Allman.)
4. *Sertularella cylindritheca* (Allman). Part of branch (enlarged). (From Allman's type specimen.)
5. *Sertularella distans* (Allman). Part of branch (enlarged).
6. *Sertularella distans.* Two hydrothecæ (greatly enlarged).
7. *Sertularella gigantea* Mereschkowsky (slightly enlarged). (After Mereschkowsky.)

SERTULARIDÆ.

EXPLANATION TO PLATE XX.

FIG. 1. *Sertularella amphorifera* Allman. Part of branch (enlarged).
2. *Sertularella amphorifera*. End of hydrotheca (greatly enlarged).
3. *Sertularella fusiformis* Hincks (enlarged). (After Hincks.)
4. *Sertularella fusiformis*. Gonangium (enlarged). (After Hincks.)
5. *Sertularella picta* (Meyen). Part of colony (enlarged). (After Meyen.)
6. *Sertularella picta*. Single hydrotheca (greatly enlarged). (After Hartlaub.)
7. *Sertularella picta*. Part of branch with gonangium (enlarged). (After Hartlaub.)
8. *Sertularella megastoma* Nutting. Part of branch (enlarged).
9. *Sertularella megastoma*. Part of branch with gonangium (enlarged).
10, 11. *Sertularella solitaria* Nutting. Single hydrothecæ (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXI.

FIG. 1. *Sertularella polyzonias* (Ellis and Solander). Part of branch (enlarged).

2. *Sertularella polyzonias.* Gonangium (enlarged).

3. *Sertularella clausa* (Allman). Part of branch from Allman's type (enlarged).

4. *Sertularella clausa.* End of hydrotheca, showing operculum, from Allman's type (greatly enlarged).

5. *Sertularella complexa* Nutting. Part of branch (enlarged).

6. *Sertularella complexa.* End of hydrotheca, showing operculum (greatly enlarged).

7. *Sertularella complexa.* Gonangium (enlarged).

8, 9. *Sertularella complexa.* Gonangia viewed from above, showing teeth (enlarged).

10. *Sertularella pinnata* Clark. Part of colony with gonangia (enlarged).

11. *Sertularella pinnata.* Part of branch, front view (enlarged).

12. *Sertularella pinnata.* Single hydrotheca (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXII.

FIG. 1. *Sertularella margaritacea* Allman. Part of branch with gonangium (enlarged). (After Allman.)
2. *Sertularella turgida* (Trask). Part of colony with gonangium (enlarged).
3. *Sertularella turgida.* Distal part of branch (enlarged).
4, 5. *Sertularella turgida.* Ends of hydrothecæ, showing teeth (greatly enlarged).
6. *Sertularella sieboldi* Kirchenpauer. Part of branch (enlarged). (After Kirchenpauer.)
7. *Sertularella sieboldi.* Gonangium (enlarged). (After Kirchenpauer.)
8. *Sertularella subdichotoma* Kirchenpauer. Part of colony, showing branching (enlarged).
9. *Sertularella subdichotoma.* Hydrotheca, showing margin (greatly enlarged).
10. *Sertularella subdichotoma.* End of hydrotheca, showing operculum (greatly enlarged).
11, 12. *Sertularella subdichotoma.* Gonangia (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXIII.

FIG. 1. *Sertularella filiformis* (Allman). Branch with gonangium, from Allman's type specimen (enlarged).

2, 3. *Sertularella filiformis*. Hydrothecæ, from same specimen (greatly enlarged).

4. *Sertularella quadrifida* Hartlaub. Part of Allman's type of *Sertularia quadridens* Allman (enlarged).

5. *Sertularella quadrifida*. Three hydrothecæ from same specimen (greatly enlarged).

6, 7. *Sertularella quadrifida*. Hydrothecæ from same specimen, showing teeth and opercula (greatly enlarged).

8. *Sertularella meridionalis* Nutting. Part of branch with gonangium (enlarged).

9. *Sertularella meridionalis*. Single hydrotheca, showing teeth and operculum (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXIV.

FIG. 1. *Sertularella elegans* Nutting. Part of colony with gonangium (enlarged).

2. *Sertularella milneana* (d'Orbigny). Part of branch (enlarged).

3, 4. *Sertularella milneana.* Ends of hydrothecæ, showing teeth and opercula (greatly enlarged).

5. *Sertularella milneana.* Gonangium (enlarged).

6. *Sertularella magellanica* (Marktanner-Turneretscher). Lower part of colony (enlarged).

7. *Sertularella magellanica.* Distal part of colony (enlarged).

8. *Sertularella magellanica.* End of hydrotheca, showing teeth (enlarged).

9. *Sertularella minuta* Nutting. Part of colony with gonangium (enlarged).

10. *Sertularella minuta.* End of hydrotheca, showing teeth (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXV.

Fig. 1. *Sertularella dentifera* Torrey. Part of colony (enlarged). (After Torrey.)

2. *Sertularella dentifera.* Two hydrothecæ, showing reduplicated margins (enlarged). (After Torrey.)

3. *Sertularella tricuspidata* (Alder). Part of colony (enlarged).

4, 5. *Sertularella tricuspidata.* Gonangia (enlarged).

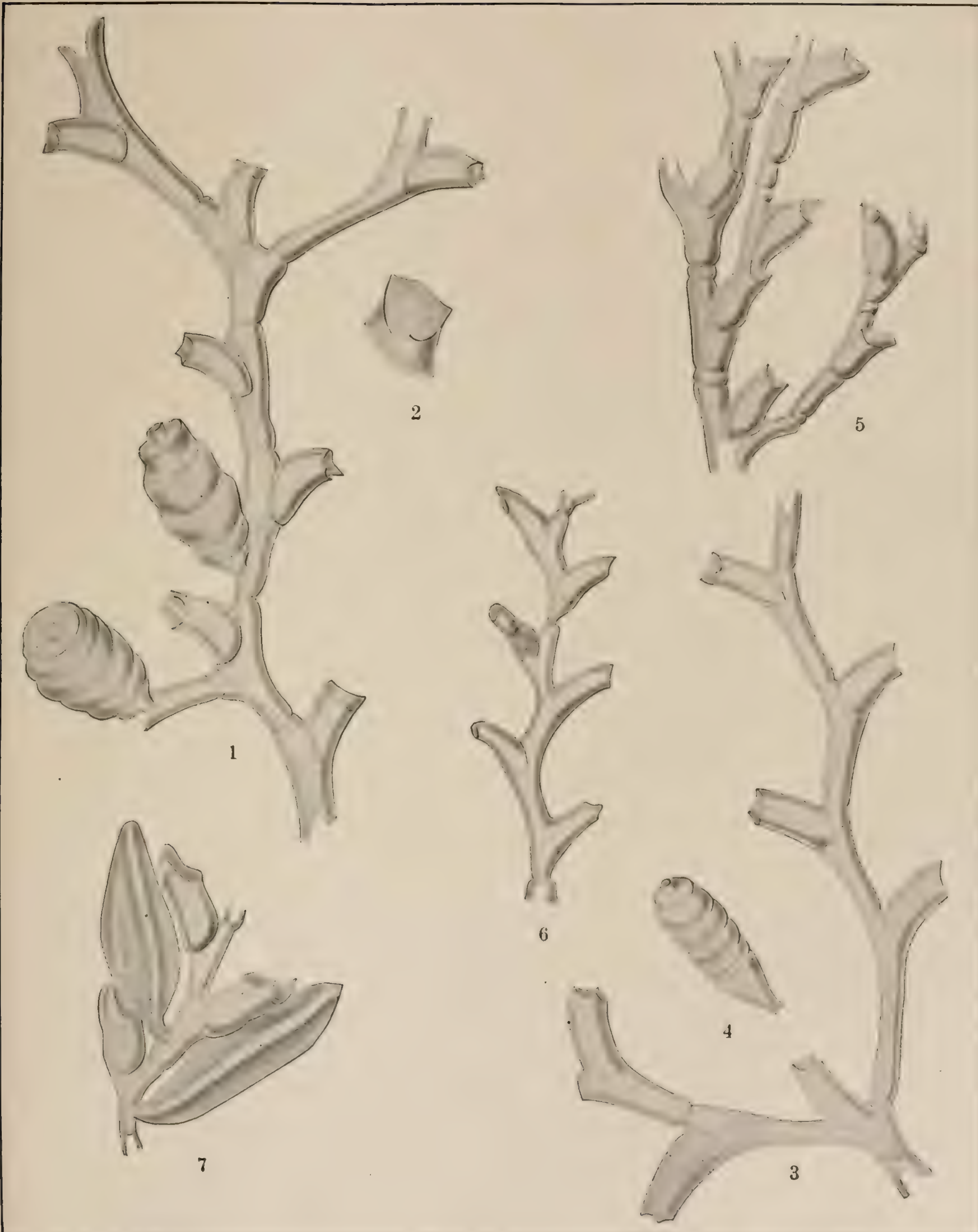
6. *Sertularella tricuspidata* (large form from Alaska). Part of colony (enlarged).

7. *Sertularella tricuspidata.* Single hydrotheca (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXVI.

FIG. 1. *Sertularella levinseni* Nutting. Part of colony with gonangia (enlarged).
2. *Sertularella levinseni.* End of hydrotheca (greatly enlarged).
3. *Sertularella tropica* Hartlaub. Part of colony (enlarged). (After Clarke.)
4. *Sertularella tropica.* Gonangium (enlarged). (After Clarke.)
5. *Sertularella clarkii* Mereschkowsky. Part of colony (enlarged). (After Mereschkowsky.)
6. *Sertularella nana* Hartlaub. Part of branch (enlarged). (After Hartlaub.)
7. *Sertularella episcopus* Allman. Part of colony with gonangia (enlarged). (After Allman.)



SERTULARIDÆ.

EXPLANATION TO PLATE XXVII.

FIG. 1. *Sertularella magna* Nutting. Two hydrothecæ (much less enlarged than other figures).
2. *Sertularella formosa* Fewkes. Branch overgrown with parasitic campanularian (enlarged).
3. *Sertularella formosa.* Part of Allman's type of *Sertularia integritheca* Allman (enlarged).
4. *Sertularella formosa.* Part of stem with gonangia (enlarged).
5. *Sertularella hartlaubi* Nutting. Part of stem, showing branch origins (enlarged).

SERTULARIDÆ.

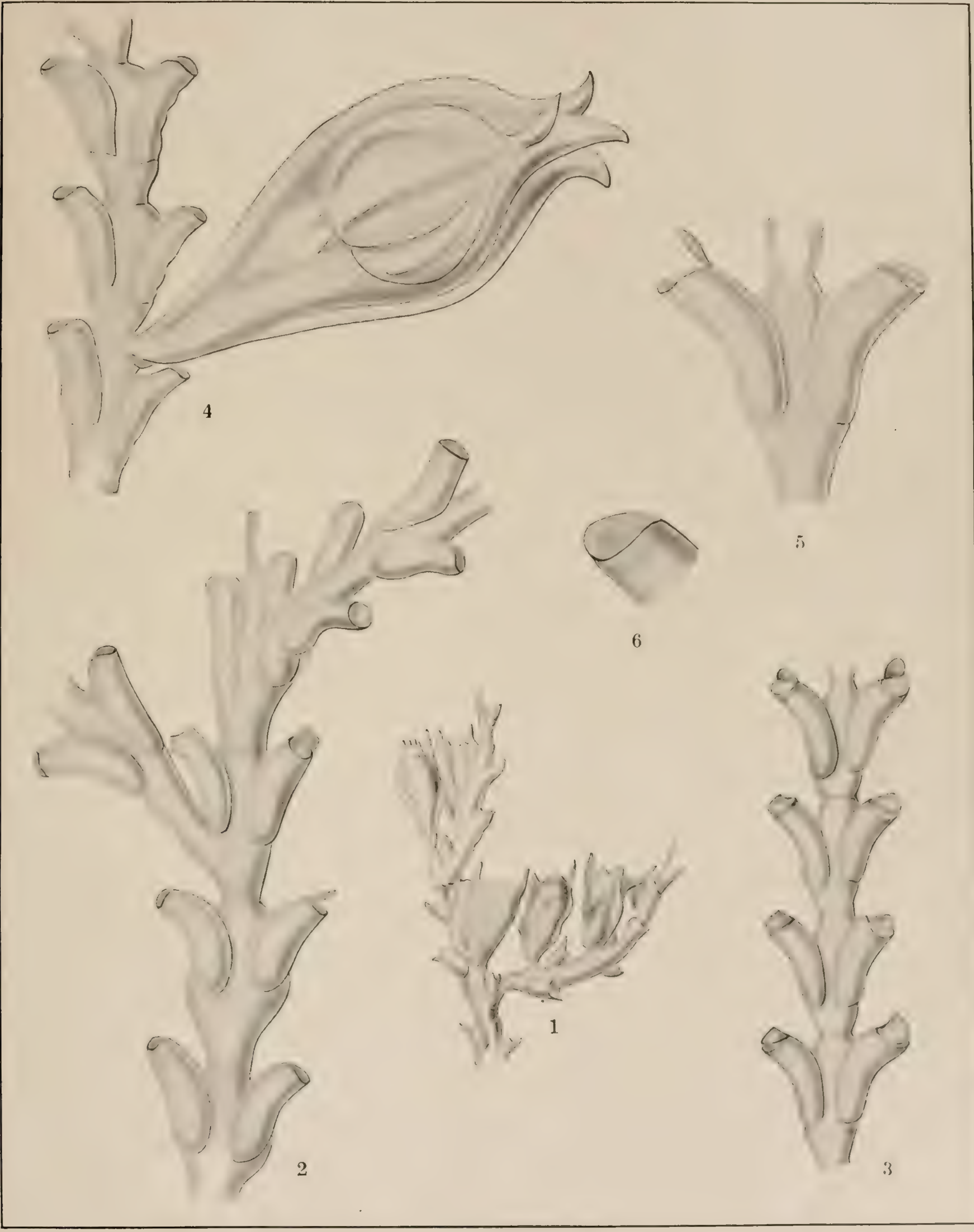
EXPLANATION TO PLATE XXVIII.

Fig. 1. *Dictyocladium flabellum* Nutting. Part of colony with gonangia (enlarged).
2. *Dictyocladium flabellum.* Part of branch (enlarged).
3. *Dictyocladium flabellum.* End of hydrotheca, showing teeth and operculum (enlarged).
4. *Diphasia rosacea* (Linnæus). Branch with female gonangium (enlarged).
5. *Diphasia rosacea.* Side view of branch with gonangium (enlarged).
6. *Diphasia tamarisca* (Linnæus). Two pairs of hydrothecæ (enlarged). (After Hincks.)
7. *Diphasia tamarisca.* Portion of colony with gonangia (enlarged). (After Hincks.)

Sertularidæ.

EXPLANATION TO PLATE XXIX.

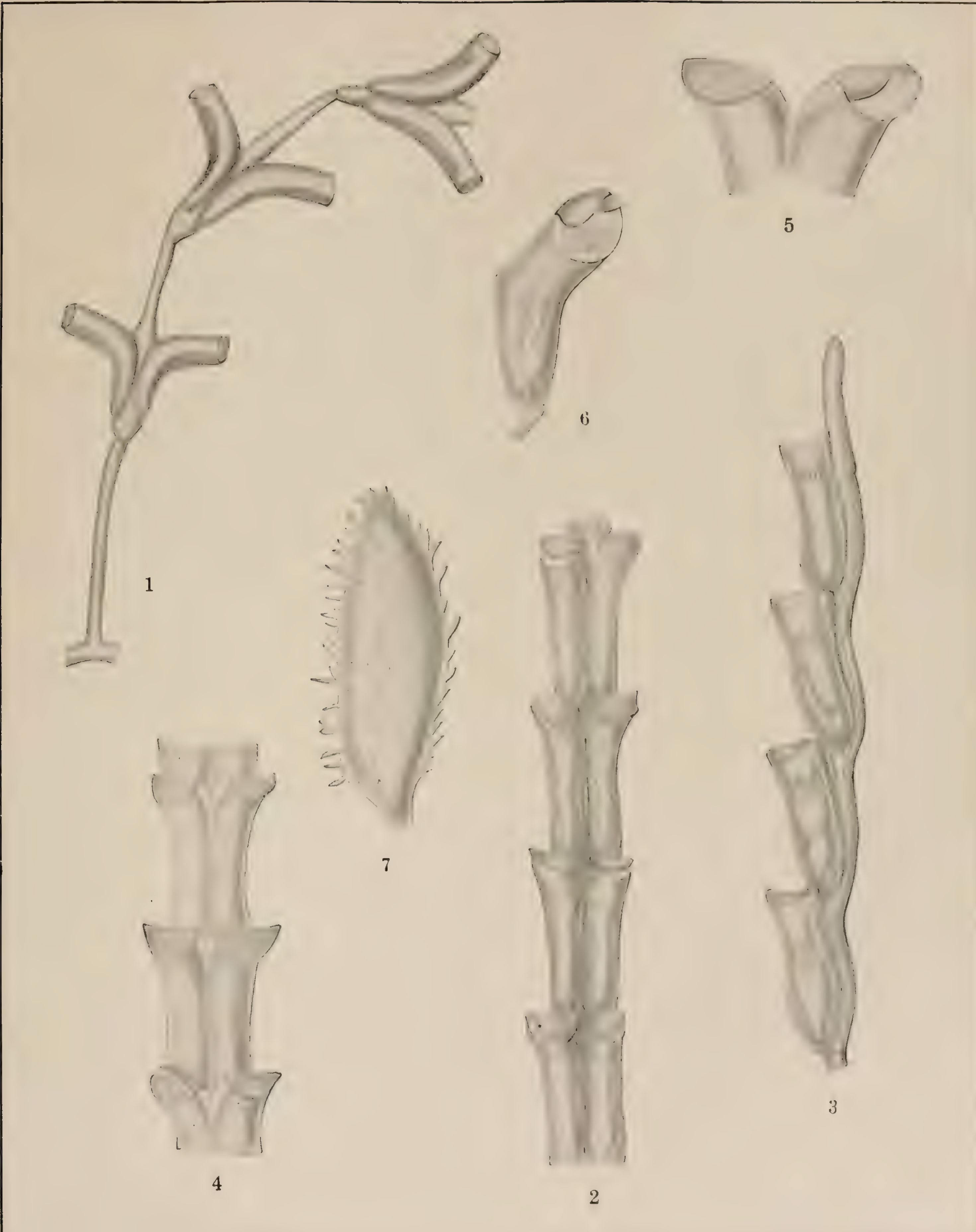
FIG. 1. *Diphasia corniculata* (Murray). Part of colony (enlarged). (After Murray.)
2. *Diphasia fallax* (Johnston). Part of colony, showing branching (enlarged).
3. *Diphasia fallax.* Front view of branch (enlarged).
4. *Diphasia fallax.* Part of branch with gonangium (enlarged).
5. *Diphasia fallax.* Pair of hydrothecæ (greatly enlarged).
6. *Diphasia fallax.* End of hydrotheca, showing operculum (greatly enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XXX.

FIG. 1. *Diphasia tropica* Nutting. Part of colony (enlarged).
2. *Diphasia digitalis* (Busk). Front view of branch (enlarged).
3. *Diphasia digitalis.* Side view of branch (enlarged).
4. *Diphasia digitalis.* Part of Allman's type of *Desmoscyphus acanthocarpus* Allman (enlarged).
5. *Diphasia digitalis.* Distal ends of two hydrothecæ, showing the hood-like operculum (greatly enlarged).
6. *Diphasia digitalis.* Single hydrotheca, showing what appear to be opercular muscles (greatly enlarged).
7. *Diphasia digitalis.* Gonangium (enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XXXI.

FIG. 1. *Diphasia pulchra* Nutting. Two hydrothecæ (greatly enlarged).
2. *Diphasia pulchra.* Part of colony (enlarged).
3. *Diphasia pulchra.* Part of branch (enlarged).
4. *Diphasia paarmanni* Nutting. Part of branch with male gonangia (enlarged).
5. *Diphasia paarmanni.* Female gonangium (enlarged).
6. *Diphasia paarmanni.* End of hydrotheca, showing operculum (much enlarged).
7. *Diphasia kincaidi* (Nutting). Distal end of branch with gonangia (enlarged).
8. *Diphasia kincaidi.* Four hydrothecæ (greatly enlarged).
9. *Diphasia kincaidi.* Gonangium (greatly enlarged).

SERTULARIDÆ.

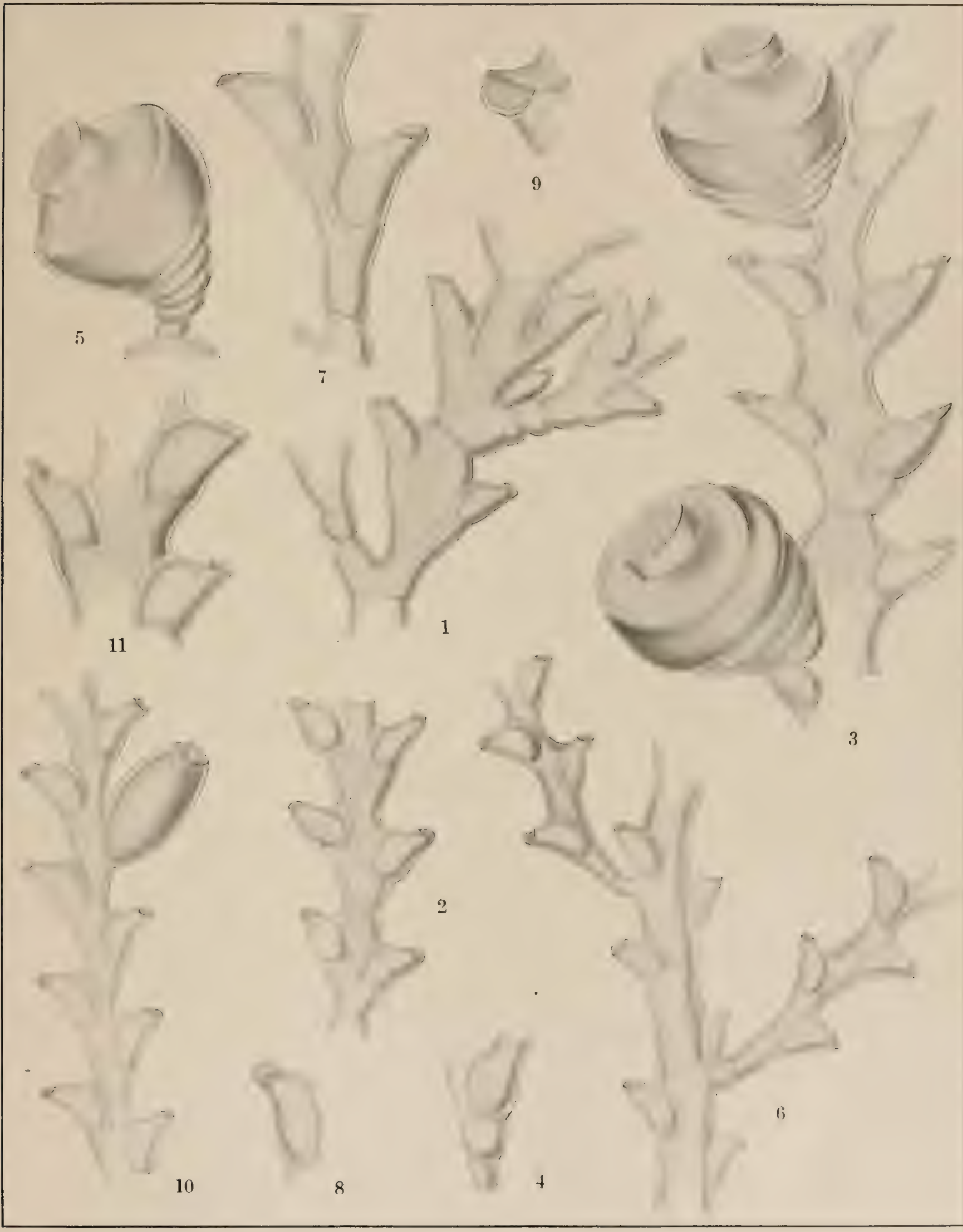
EXPLANATION TO PLATE XXXII.

Fig. 1. *Abietinaria abietina* (Linnæus). Part of colony (enlarged).
2. *Abietinaria abietina*. Part of a branch (much less magnified).
3. *Abietinaria abietina*. Two hydrothecæ, showing operculum (much enlarged).
4. *Abietinaria variabilis* (Clark). Part of colony, showing branching (enlarged).
5. *Abietinaria variabilis*. Four hydrothecæ (much enlarged).
6. *Abietinaria variabilis*. Group of gonangia (enlarged).
7. *Abietinaria variabilis*. Gonangium (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXXIII.

FIG. 1. *Abietinaria inconstans* (Clark). Part of colony (enlarged).
2. *Abietinaria inconstans.* Part of branch (enlarged).
3. *Abietinaria coei* (Nutting). Part of branch with gonangia (enlarged).
4. *Abietinaria coei.* Single hydrotheca, showing sinuation of margin (enlarged).
5. *Abietinaria coei.* Top-shaped gonangium (enlarged).
6. *Abietinaria traski* (Torrey). Part of colony, showing branching (enlarged).
7. *Abietinaria traski.* Two hydrothecæ (greatly enlarged).
8, 9. *Abietinaria traski.* Ends of hydrothecæ, showing opercula (greatly enlarged).
10. *Abietinaria traski.* Branch with gonangium (enlarged).
11. *Abietinaria traski.* Three hydrothecæ from another colony (greatly enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XXXIV.

Fig. 1. *Abietinaria filicula* (Ellis and Solander). Part of branch (much enlarged)
2. *Abietinaria amphora* Nutting. Part of branch (enlarged).
3. *Abietinaria amphora.* Distal part of branch (enlarged).
4. *Abietinaria amphora.* Part of branch with gonangium (enlarged).
5. *Abietinaria anguina* (Trask). Part of branch with very slender hydrothecæ (enlarged).
6. *Abietinaria anguina.* Part of branch with gonangia (enlarged).
7. *Abietinaria anguina.* Single gonangium (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXXV.

FIG. 1. *Abietinaria gracilis* Nutting. Part of colony with gonangium (enlarged).

2. *Abietinaria gracilis.* Four hydrothecæ (greatly enlarged).

3. *Abietinaria compressa* (Mereschkowsky). Part of branch (enlarged). (After Mereschkowsky.)

4. *Abietinaria compressa.* Single hydrotheca (much enlarged). (After Mereschkowsky.)

5. *Abietinaria alexanderi* Nutting. Part of stem and branches (enlarged).

6. *Abietinaria alexanderi.* Part of branch and gonangium (enlarged).

7. *Abietinaria alexanderi.* Gonangium, showing meridional lines (enlarged).

8. *Abietinaria alexanderi.* Gonangium (greatly enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXXVI.

FIG. 1. *Abietinaria greenei* (Murray). Part of branch (enlarged).
2. *Abietinaria greenei*. Four hydrothecæ (enlarged).
3. *Abietinaria greenei*. Pair of hydrothecæ with toothed margins (much enlarged).
4. *Abietinaria greenei*. Pair of hydrothecæ with even margins (greatly enlarged).
5. *Abietinaria greenei*. Side view of hydrothecæ (enlarged).
6. *Abietinaria greenei*. Side view of hydrothecæ (much enlarged).
7, 8. *Abietinaria greenei*. Gonangia (enlarged).
9. *Abietinaria costata* (Nutting). Part of branch (enlarged).
10. *Abietinaria costata*. Part of main stem, showing branch origins (enlarged).
11. *Abietinaria costata*. Four hydrothecæ (greatly enlarged).
12. *Abietinaria costata*. Group of gonangia (enlarged).
13. *Abietinaria annulata* (Kirchenpauer.) Part of main stem and branches (enlarged).
14. *Abietinaria annulata*. Part of branch (enlarged).
15. *Abietinaria annulata*. Side view of three hydrothecæ (enlarged).

SERTULARIDÆ.

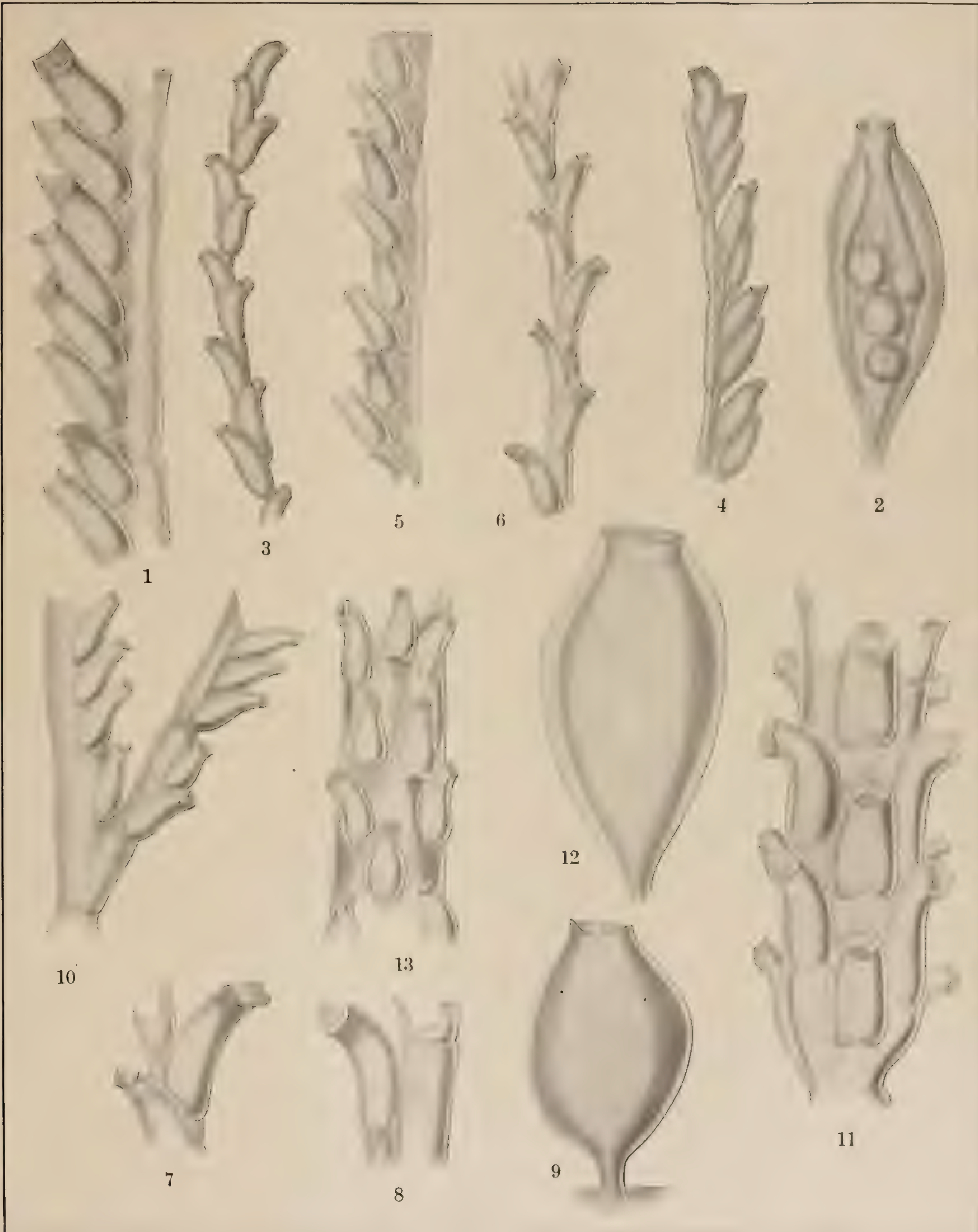
EXPLANATION TO PLATE XXXVII.

FIG. 1. *Abietinaria turgida* (Clark). Part of stem and branch (enlarged).
2. *Abietinaria turgida.* Gonangium (enlarged).
3. *Abietinaria gigantea* (Clark). Part of branch (enlarged).
4. *Abietinaria gigantea.* Side view of branch, with gonangia (enlarged).
5. *Abietinaria gigantea.* Side view of three hydrothecæ (enlarged).

SERTULARIDÆ.

EXPLANATION TO PLATE XXXVIII.

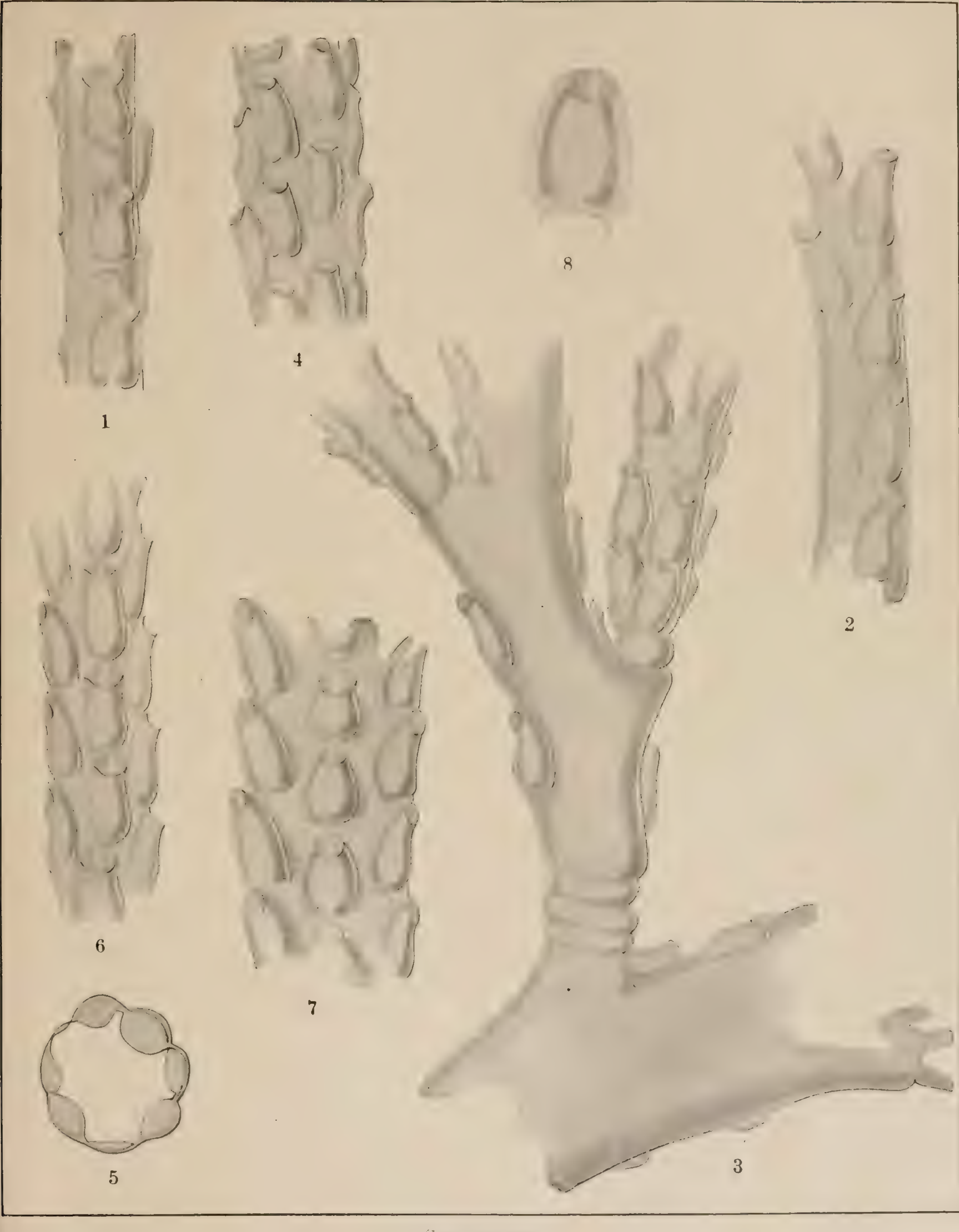
FIG. 1. *Hydrallmania falcata* (Linnæus). Side view of branch (greatly enlarged).
2. *Hydrallmania falcata.* Gonangium (enlarged).
3. *Hydrallmania falcata.* Front view of end of branch (enlarged).
4. *Hydrallmania falcata.* Side view of end of branch (enlarged).
5. *Hydrallmania distans* Nutting. Part of branch, side view (enlarged).
6. *Hydrallmania distans.* Front view of branch (enlarged).
7, 8. *Hydrallmania distans.* Front view of hydrothecæ (much enlarged).
9. *Hydrallmania distans.* Gonangium (enlarged).
10. *Hydrallmania franciscana* (Trask). Part of colony (enlarged). (After Trask.)
11. *Selaginopsis mirabilis* (Verrill). Part of branch (enlarged).
12. *Selaginopsis mirabilis.* Gonangium (enlarged).
13. *Selaginopsis pinaster* (Lepechin). Part of branch (enlarged). (After Kirchenpauer.)



SERTULARIDÆ.

EXPLANATION TO PLATE XXXIX.

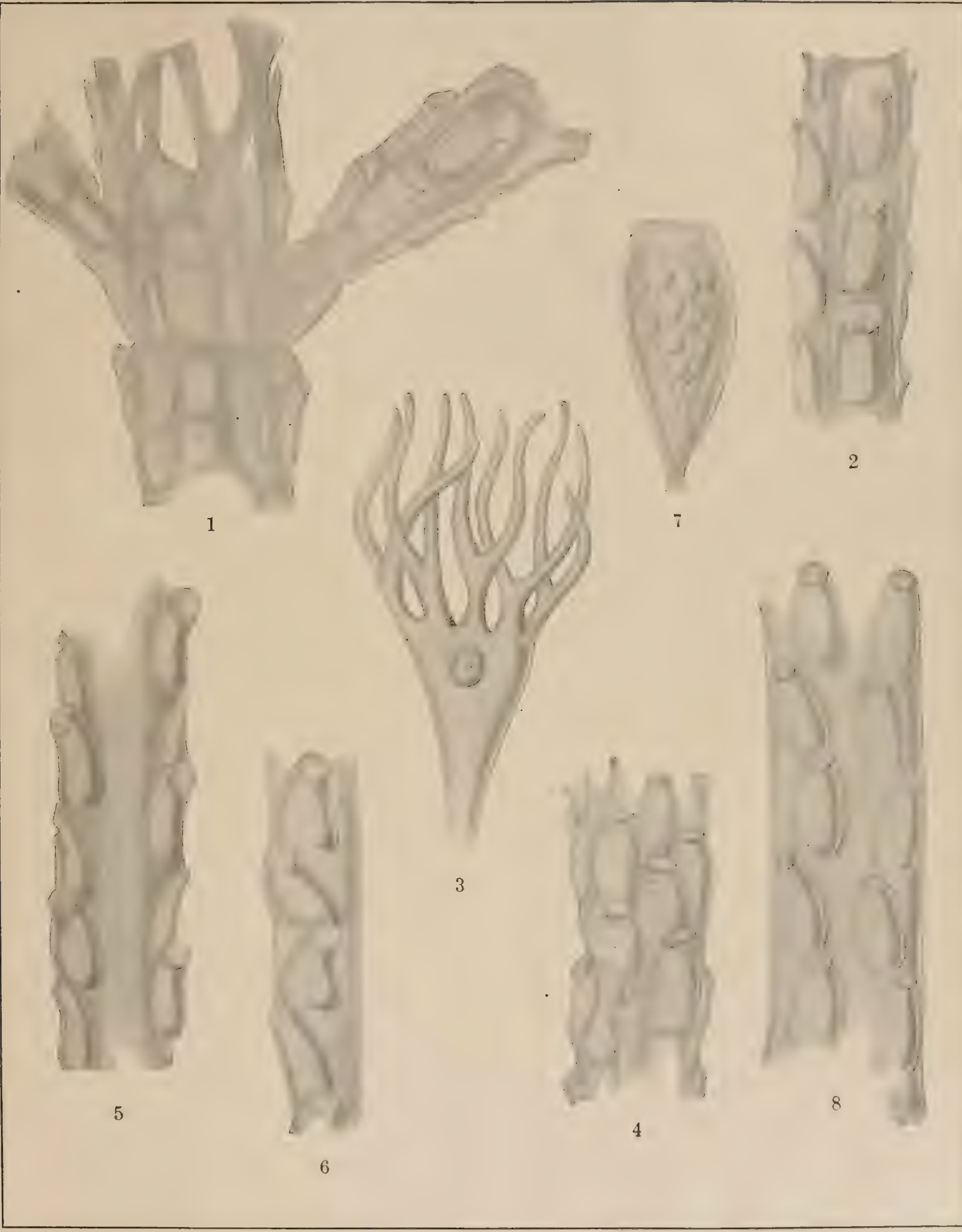
FIG. 1. *Selaginopsis triserialis* Mereschkowsky. Part of branch (enlarged).
2. *Selaginopsis triserialis.* Basal part of branch (enlarged).
3. *Selaginopsis pluniformis* Nutting. Part of main stem, branch and branchlets, showing manner of branching (enlarged).
4. *Selaginopsis obsoleta* (Lepechin). Part of branch (enlarged).
5. *Selaginopsis obsoleta.* Cross section of branch (enlarged).
6. *Selaginopsis pinnata* Mereschkowsky. Part of branch (enlarged).
7. *Selaginopsis cylindrica* (Clark). Part of branch (enlarged).
8. *Selaginopsis cylindrica.* Single hydrotheca (greatly enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XL.

FIG. 1. *Selaginopsis ornata* Nutting. Part of stem, showing canaliculated cœnosarc (enlarged).
2. *Selaginopsis ornata.* Part of a branch (enlarged).
3. *Selaginopsis ornata.* Gonangium (enlarged).
4. *Selaginopsis obsoleta* (Lepechin). Part of branch (enlarged). (After Kirchenpauer.)
5. *Selaginopsis alternitheca* (Levinsen). Front view of part of branch (enlarged).
6. *Selaginopsis alternitheca.* Side view of part of branch (enlarged).
7. *Selaginopsis alternitheca.* Gonangium (enlarged).
8. *Selaginopsis hartlaubi* Nutting. Part of branch (enlarged).



SERTULARIDÆ.

EXPLANATION TO PLATE XLI.

Fig. 1. *Synthecium tubithecum* (Allman). Part of colony, showing opposite branches (enlarged).
2. *Synthecium rectum* Nutting. Part of colony (enlarged).
3. *?Synthecium marginatum* (Allman). Part of branch (enlarged). (After Allman.)
4. *Synthecium robustum* Nutting. Part of colony with gonangia (less enlarged).
5. *Synthecium robustum.* Part of branch, front view (enlarged).
6. *Synthecium robustum.* Part of branch, side view (enlarged).
7. *Synthecium cylindricum* (Bale). Part of branch (enlarged). (After Bale.)

SERTULARIDÆ.

INDEX.

[The figures in black-faced type indicate references to the formal descriptions in the systematic part of the work.]

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